

# BIO@SU

FALL 2010

Communications with Alumni and Friends

THE DEPARTMENT OF BIOLOGY AT SYRACUSE UNIVERSITY

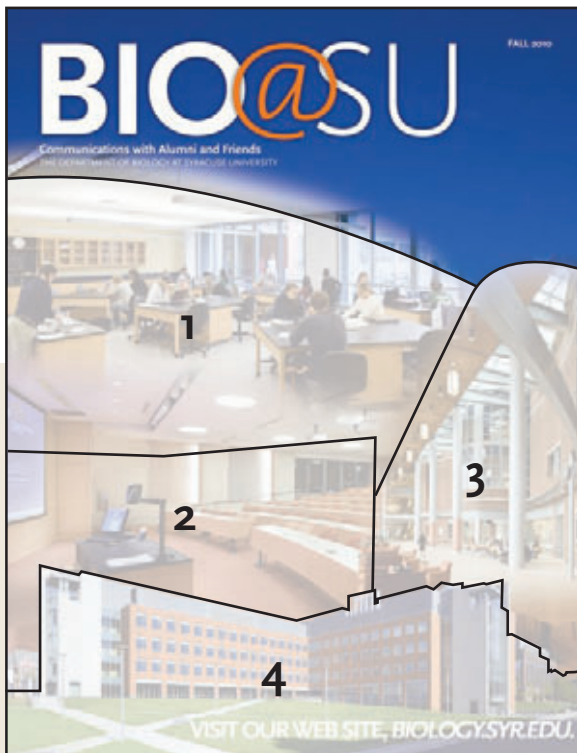


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# Contents



Note from the Editor	1
Letter from the Chair	2
Faculty Profile: Jason Wiles	4
Faculty Profile: Michael Cosgrove	7
Newhouse Faculty Profile: Lawrence Mason	10
Graduate Student Profile: Aditya Dutta	14
Graduate Student Profile: Stephanie Eby	15
Graduate Student Profile: Nicole Jacobs	17
Undergraduate Student Profile: Kali Henn	19
Undergraduate Student Profile: Amy Rabideau	20
Undergraduate Student Profile: Jamie Rachelle Sherman	22
Undergraduate Research Conference	23
A Journey Back in Memory and Time, Leipzig 2009	24
Faculty News	30
Undergraduate Activities and Achievements	31
Graduate News and Achievements	32
Alumna Profile: Allison Fryer	32
Alumna Profile: Lisa Yeh	34
Who, What, When, Where	36
Alumni Giving	37



## ON THE COVER

Photos of the Life Sciences Complex  
 Anton Grassl, Boston (1,2,3)  
 David Revette, Syracuse (4)  
 Photos courtesy of Ellenzweig,  
 architect for the Life Sciences Complex



# Notes

## FROM THE EDITOR



It has often been claimed that teaching is the profession in which one touches the future. While that may be true, none of us knows what that future holds. This issue includes profiles of four of our alumni, **Allison Fryer, Michael Cosgrove, Larry Mason and Lisa Yeh**, all of whom I knew as students. Their stories remind us how unpredictable occurrences and opportunities, many seeming minor at the time, change the direction of our lives.

Many of our alumni were students in one or more of **Professor Richard Levy's** classes, and others such as myself have known him as a colleague and friend for many years. In this edition of *BIO@SU* is the story of how he and his mother and sister escaped Nazi Germany at the eve of the Holocaust. Dick's story is not only one of narrow escape, but also of trying to come to terms with those terrible events when he returned to Leipzig almost 70 years later at the invitation of a German television program. It is a sobering reminder that events which many of us see as "long before our time" and "occurring in a distant land" are in some manner close at hand, and I suspect few who read Dick's story will forget it.

Many of the articles in this issue are about the future, both of the department and of our students and newest alumni. **Jason Wiles**, Marvin Druger's replacement in teaching introductory biology, tells the interesting story of how he became a leader in teaching and preparing others to teach evolution. **Michael Cosgrove** is wearing two hats in writing for this issue of *BIO@SU*: an alumnus and now a faculty member of

the Dept. of Biology. Thus, his profile is both an autobiography and a description of his scientific interests. Three graduate students – **Aditya Dutta, Stephanie Eby and Nicole Jacobs** – provide windows into the diversity of graduate research in our department. Finally, the Dept. of Biology and its predecessors have a long history of encouraging and supporting undergraduate research. I have asked three graduating seniors – **Kali Henn, Amy Rabideau, and Jamie Sherman** – to write short profiles of themselves and their undergraduate research as they complete their studies at SU and prepare to enter advanced studies at other institutions.

Now that I am retired, I am largely divorced from the day-to-day happenings in the department and contacts with students. Thus, I am dependent on the staff and colleagues to help me gather information. I want to especially thank Deborah Herholtz, Evelyn Lott and Sally Hallahan for helping me gather information on students. Evelyn also took a number of the snapshots included in this issue. Prof. Larry Wolf helped me double-check my facts and directed me to

students he thought I should ask to write profiles. Larry will be sorely missed as he retires.

Dick Levy has an uncanny ability to locate information on alumni, perhaps to some degree because he has been working on and now is completing the history of the department from its origin in the early 1870s to the present. The changing nature of biology over 140 years mixed with the evolution of Syracuse University from a small sectarian, even parochial, college to a major university is an interesting story, peopled with remarkable characters. I would urge all our readers to look for this history when it is published.

Finally, I again request all alumni to send me updates on your doings and whereabouts. I'm sure your peers from long ago (or not so long ago) will be interested in what you have been up to. I am also anxious to receive comments about articles in *BIO@SU* and suggestions for future stories. If you have questions about what is happening in the department, I'll be happy to try to provide answers or find someone who is able to do so. My e-mail address is [hehemphi@syr.edu](mailto:hehemphi@syr.edu). My mail address is Ernest Hemphill, Rm. 114, Life Sciences Complex, 107 College Place, Syracuse NY 13244.

# Letter

## FROM THE CHAIR

Another busy and event-filled year has come and gone, and it is time for me to update the biology alumni on what is happening in the department. We are still reveling in the new Life Sciences Complex as faculty and students alike continue to learn about and appreciate its many wonderful features.



**Update on our Undergraduates:** In May, we graduated 128 seniors with degrees in biology plus 27 with degrees in biochemistry. I don't know if that is the highest number in the history of SU biology or not, but it is the highest number in the past 11 years – that I know for sure! As was the case last year, our seniors were extremely successful in the classroom during their time at SU. This year 12 of our graduating seniors were members of the University's prestigious Renée Crown University Honors Program, and 10 were elected to Phi Beta Kappa. An astounding 55 of our seniors graduated cum laude, magna cum laude or summa cum laude!

The number of undergraduates now majoring in biology continues to grow at the rate of nearly 10% per year. This past spring semester we had 390 biology majors plus 77 biochemistry majors. This is the 11th straight year in which the number of biology majors has increased. In order to accommodate this remarkable growth the faculty in the Department of Biology have, since 2002, developed 10 new courses and increased the number of undergraduate teaching laboratory sections by more than 125%, including new labs in molecular biology, biotechnology, bioinformatics, animal behavior and evolution, and a field biology course in which the students spend a week at the Archbold Biological

Station in South-Central Florida. We have managed (somehow) to do all this with a faculty whose size is the same as it was in 2002.

Over the past decade, the Department of Biology faculty has undergone a significant turnover as many of our senior colleagues have retired. Since 2000, we have hired 14 new faculty members, and over the same period 15 of our colleagues have either retired or moved to other institutions. Thus, for many SU biology alums, there will be a number of new faces when next you visit the campus! In fact our newest addition, *Katharine Lewis*, joined us on July 1, coming from her prestigious Royal Society Fellowship at Cambridge University (UK). Her research focus is on spinal cord neuron development using zebrafish as her model. Hers is the first of what is likely to be several faculty hires in the area of developmental neurobiology at Syracuse University.

In addition to addressing the ever-increasing undergraduate teaching responsibilities, our faculty have managed to be quite active on the research front as well, publishing more than 60 research papers, sitting on important grant review panels, delivering invited talks, and winning several new grants, including two grants from the prestigious National Institutes of Health.

### **Two Long-time Colleagues Retire this**

**Year:** The academic year just coming to a close marks the last year as regular faculty members for two of our esteemed colleagues: *Larry Wolf* and *Reed Hainsworth*. It seems appropriate to comment a bit about each and what they have contributed to SU biology.

Larry earned his Ph.D. from the University of California, Berkeley in 1966 and joined the Department of Zoology (precursor to the Department of Biology) faculty as an assistant professor in 1967. He became professor of biology in 1976. He has published more than 100 scholarly articles and was co-author (with Emeritus Professor *Samuel McNaughton*) of the highly influential textbook *General Ecology*. Wolf and his research students worked in critical areas of behavioral ecology. His scholarly papers focused on the behavioral ecology of aggression across a wide variety of organisms; on mating and reproductive ecology in arthropods and birds; and on foraging and territoriality. For all this, he was awarded Fellow status in the American Association for the Advancement of Science (AAAS)—a highly competitive level of recognition.

At Syracuse University, Professor Wolf was an important member of the group that developed and instituted the Renée Crown University Honors Program. He also served as a founding

member of that program's Core Faculty. This was a logical extension of his long and dedicated service to the Department of Biology's Honors Program that he oversaw for many years. (In addition to the Honors Program, the department retains a thesis-driven program awarding a degree with distinction in biology.) He worked tirelessly to develop a campus-wide (and intercollegiate) environmental sciences and policy program that will take advantage of the enormous scientific and public policy strengths available on the SU and SUNY-ESF campuses. At the same time, he has almost single-handedly kept alive the interdisciplinary environmental sciences program between the departments of biology and earth sciences.

While serving as the project shepherd for the new Life Sciences Complex, Larry made sure this new facility was state-of-the-art for the researchers, and that it provided our undergraduate and graduate students with not only outstanding classrooms, but lots of break-out spaces and spaces to meet and/or study. One only has to walk through this new facility observing students studying and conversing (and OK, sometimes sleeping!) to see how well his ideas for these spaces are working.

For the Department of Biology, Professor Wolf has served as the associate chair of undergraduate affairs since 2002. It was in his role as associate chair that I came to rely quite heavily on his wisdom, insight, and unfailing ability to ask the right questions. It is safe to say that I and everyone in the Department of Biology will miss having the benefit of Professor Wolf's presence among us in the coming years. In the short run, he and his wife, Janet, plan to remain in Syracuse.

Professor Reed Hainsworth earned his Ph.D. from the University of Pennsylvania in 1968 and became an assistant professor of zoology (later biology) in 1969. He became professor of biology in 1977. Over his more than 40 years as a scientist, Reed published 79 scholarly papers in the area of physiological ecology of animals. During his later years on our faculty, he undertook (without complaint!) the herculean task of principal advisor for undergraduates majoring in biology,

which meant he was personally serving as the academic advisor to more than 100 students per year! In addition, Reed was the source of information for his colleagues in biology on all matters pertaining to providing accurate and sound academic advice to our undergraduates. Each of us in the Department of Biology has called Reed more than once to get precise clarification about academic rules and regulations. We will sorely miss him. He and his wife, Diane, have moved to Denver, Colo. to be nearer children and grandchildren.

**New Biotechnology Major:** The upcoming year will see a new undergraduate major being offered through the Department of Biology. Through the hard work of Surabhi and Ramesh Raina, an interdisciplinary biotechnology major has been developed and approved by the University and the State of New York. This program will offer SU students an opportunity to take courses in biology, environmental sciences, chemistry, engineering, law, management and public policy important for addressing biotechnology-related issues. It is designed to help our students prepare for jobs in areas such as the biotech industry, health professions, pharmaceutical industry and research in academia. The program requires the same basic courses as the B.S. degree in biology with substitution of elective courses in engineering, law, management and public policy. Also, a senior year capstone class (Biotechnology Seminar) and internship is required.

**New Undergraduate Biology Curriculum:** Beginning with the class entering SU this coming fall (2010), there will be a new undergraduate curriculum for biology majors. The result of more than two years of faculty discussions and planning, the new curriculum will provide all our students meaningful exposure to the full gamut of the life sciences. Our faculty strongly believes the future of life sciences will be driven by individuals who have a broad background rather than by those who focus too early in one area of the discipline.

**New Emeritus Chairs Fund:** H. Richard Levy, my immediate predecessor as chair of biology (1993-1999), is spearheading a campaign to encourage SU biology alumni to contribute to a fund that will support undergraduate education and faculty development. In this effort, he has the support of two former chairs of biology, Judi Foster (1982-1988) and David Sullivan (1988-1993). As former chairs of this department, they are acutely aware of the need for resources that will allow them to support highly worthy undergraduate projects, new experimental courses, etc., that are difficult to fund within a useful time-frame. This fund will provide future chairs the ability to encourage students and faculty alike to pursue their "bright ideas" without jumping through the time-consuming institutional bureaucracy. In this edition of *BIO@SU*, you will find an envelope that will allow you to contribute to this highly worthy fund. This is a great way to support the education of future SU life scientists.

**Update on the "History of Biology at SU" Project:** As I briefly mentioned in last year's edition of *BIO@SU*, Professor Emeritus H. Richard Levy, my immediate predecessor as chair, has been working on a comprehensive history of biology at Syracuse University. His exhaustive (and exhausting, he tells me!) research has uncovered some fascinating information. We are expecting this project to be finished this summer, and we are exploring means by which we can make it available to interested alumni.

In closing, I want to once again thank Professor Emeritus **Ernie Hemphill**, who for the third year has succeeded at planning and putting together this publication. As always, he has had to twist the arms of a variety of faculty, students and alumni to provide him with the interesting stories and information contained in this year's edition of *BIO@SU*. Given that Ernie's time here in SU biology exactly matches the time the Department of Biology has been in existence, he is the perfect person to serve as editor of *BIO@SU*. Once again, I urge all of you to respond to his requests for interesting stories for next year's edition and especially for updates on alumni.





## FACULTY PROFILE: Jason Wiles

Evolution is “the central unifying concept of biology,” according to the National Academy of Sciences, and it is no wonder that essentially every major scientific organization and science education society supports the teaching of evolution as the foundation of a solid education in the life sciences. Accordingly, every concept that students encounter in my introductory biology courses at Syracuse University is taught within a framework built around evolution. It’s really the only way to make sense of biology as a cohesive discipline, as was famously touted by my great predecessor’s (Marvin Druger) mentor, Theodosius Dobzhansky.

But evolution was not the foundation of my early biology education. I was born in rural Arkansas not long after a tumultuous legal battle that divided the state was finally settled by the U.S. Supreme Court. The important decision in *Epperson v. Arkansas* overturned the law that had made it illegal to teach evolution in my home state and several others since before the Scopes trial of the 1920s. After the Epperson case, many school districts attempted to “balance” the teaching of evolution with the inclusion of creationism, a practice that was struck down by a federal district court in the case of *McLean v. Arkansas* when I was in elementary school. It was not until I was headed into junior high school that the “balanced treatment” of evolution with so-called “creation science” was ruled to be unconstitutional by the U.S. Supreme Court in its decision on *Edwards v. Aguillard*, a case that arose in Louisiana just across Arkansas’s southern border.

While these landmark decisions had made it legal to teach evolution and unlawful to teach creationism in public schools, the polarizing media attention that the social controversy over these cases had drawn, as well as the heated public debate over the teaching of evolution, led to widespread neglect of the topic in Arkansas’s biology classrooms. Regardless of their personal positions on evolution, my biology teachers did not broach the subject of evolution, if for no reason other than fear of community backlash.

During my undergraduate years, the situation was little different. I earned my bachelor’s degree in biology (with a minor in Bible) from Harding University, a conservative Christian college just north of Little Rock, Arkansas. While the attitude toward evolution has apparently improved at Harding in the time since I was there, it was a subject that came up very rarely, and it was treated with uncomfortable skepticism by most when it did. I recall a few times at Harding when evolutionary ideas were discussed, and these were fairly formative events for me. One was during a lecture by a guest speaker for the Biology Department who mentioned Hardy-Weinberg equilibrium a number of times during the course of his presentation. Having never been taught the basics of population genetics,

our faces were blank with ignorance. He was shocked that the audience, mostly junior and senior biology majors, had never heard of the Hardy-Weinberg equations and assumptions. He said something like, “Come on, you all! This is introductory-level stuff!” I could not help thinking that I had missed something very important in my biology education.

About that time, I also fell in love with teaching. A professor who had been responsible for the freshman course in general zoology at Harding for decades suffered an unfortunate injury and retired unexpectedly. A new professor was brought in with very little lead time ahead of his first semester of teaching, so he was quite happy to turn over the

were playing with fire. I was not as bold as one of the tenured professors who occasionally asked leading questions around evolution, while never actually saying the “e-word,” and stopping just shy of “teaching” it directly. Both his bravery and my fear of ostracism were confirmed during what I remember as a particularly riveting session of the senior biology seminar. In that session, a senior biology major presented his research on bacterial resistance to antibiotics. During the round of questions that followed, the daring professor asked the student what it was called when the characteristics of a population of bacteria changed over time. After a long pause, which to him must have felt like hours,

“Regardless of their personal positions on evolution, my biology teachers did not broach the subject of evolution, if for no reason other than fear of community backlash.”

laboratory sections of the course to a senior biology major. I landed the job, and it was not very long before I knew I had found my calling. However, I was often frustrated when trying to explain the diversity of all of the animal phyla and their distinguishing characteristics without benefit of the framework of common ancestry. It was then that I discovered that when I had taken the course as a freshman, we had skipped all of the chapters on evolution! I had never even noticed the textbook contained those chapters. I read what I could, and I did not understand it all, but the idea of evolutionary relationships between taxa certainly seemed to explain much about the similarities and differences among them. But without the evolutionary tree, you might as well catalog the animals alphabetically from aardvark to zebra.

Given my perceptions of how others might react to my curiosity, I somewhat secretly began trying to learn more about evolution, and I sometimes felt as if I

the student timidly offered, “Evolution?” There was a collective gasp from the 100 or so students in attendance, and the professor coolly sat back and nodded, grinning to himself in quiet satisfaction. Shortly after this incident, another guest lecturer alluded to the symbiotic origin of mitochondria in eukaryotes, and I was too intrigued to let it go. So I sought out the professor who had asked the evolution question, and I cornered him on mitochondrial endosymbiosis. He smiled and said, “Jason, there is a great deal of evidence that appears to support such an hypothesis, but that’s about all I can tell you.” That was it. I was interested. I wanted to know more, but it was a hard place to learn much about evolution.

It was not too long after I left Harding that I also left Arkansas to enter a graduate program in biology at Portland State University in Oregon. I was studying the foraging ecology of sea otters, but the first class I took was evolution. It was a tough course, and



it was all the more difficult as I was still attempting to defend a creationist position – even in my responses to exam questions! But as I was learning more about the mechanisms of evolution, I was also engaged in intense training in comparative mammalian anatomy as well as the natural history of marine mammals. I started to make predictions about what I should expect to see if all of the marine mammals I was studying did in fact descend from four-legged land dwellers. The fossil record of whale ancestors is remarkably complete, and as I dissected more and more cetaceans as part of the Marine Mammal Stranding Network, I became very familiar with their anatomical features that bespeak their terrestrial heritage. Perhaps the last vestige of my creationist outlook fell when, on a hunch, I took it upon myself to explore the embryos of whales. Just as I had predicted should be the case, although they do not develop hind legs, the embryos do indeed develop hind limb buds just as their four-legged ancestors would have! While this discovery was not novel to science, it was new and profound to me. I was convinced. Understanding and acceptance of evolution, I found, made all of the seemingly disparate facts I had merely memorized about biology fall into place around a wonderfully comprehensible scaffold. It all made so much sense!

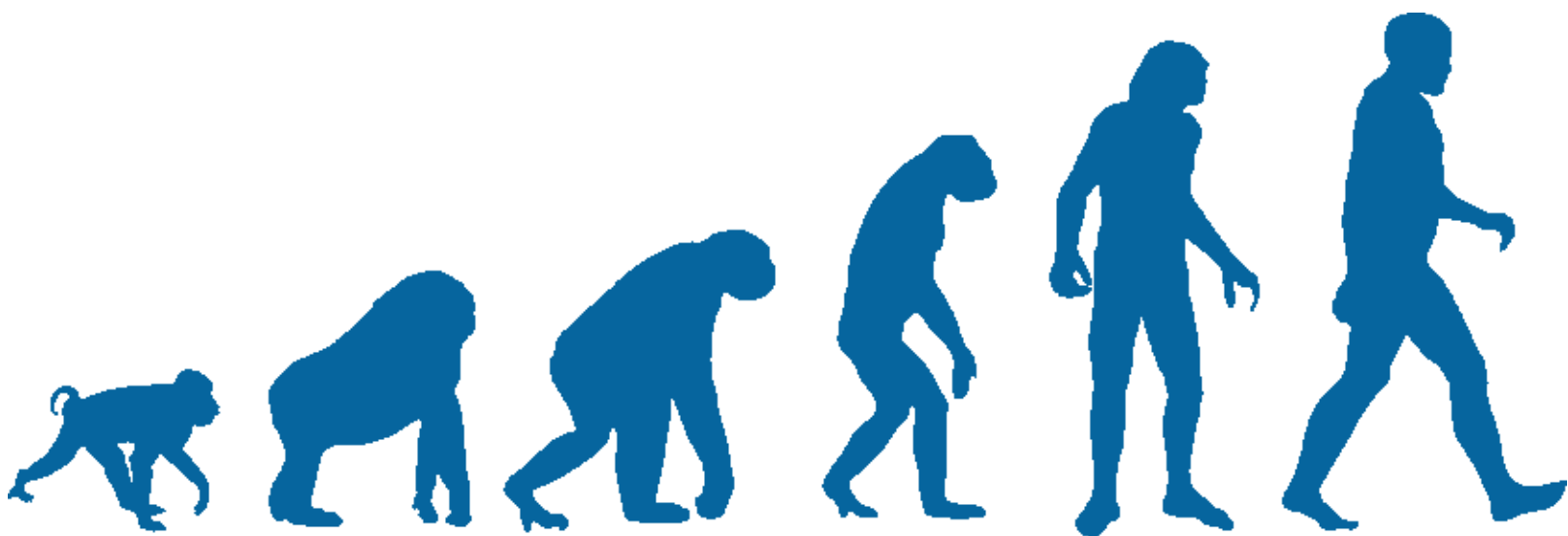
After graduating from Portland State, I began teaching biology and related science courses at a number of colleges and universities in Oregon. During several years spent as a college biology instructor, I realized that many of my students, whether they had religious concerns or not, had similar barriers to the ones that

I had when it came to understanding biology because they did not understand evolution. I thought I could make a larger contribution to the practice of teaching in the life sciences if I could embark upon a program of research exploring how students can overcome various cognitive obstacles to learning about evolutionary concepts. After some time exploring graduate programs that might allow me to engage in such an endeavor, I eventually found Professor Brian Alters at McGill University in Montréal, Canada. I joined his research group and completed my Ph.D. at McGill analyzing factors influencing student acceptance of evolution. I simultaneously earned a second master's degree in geoscience from Mississippi State University through a combination of distance learning, working among the fossil collections of McGill's Redpath Museum, and traveling to the Starkville campus.

In 2007, I joined the Biology Department at Syracuse, assuming the duties of teaching Biology 121 and 123 (and now the second semester lab designated as Biology 124) in the fall of 2008. Parallel to the introductory courses, I also offer freshman sections of Special Topics (Biology 200), including the newly designed "Introduction to Biology Research at SU." In addition, I supervise BIO 360, which offers advanced undergraduates an opportunity to participate in teaching college biology by assisting in the Bio 121 and 124 laboratories. During the summers, I teach a course called "Evolutionary Biology, Religion, and Society." Outside of the Biology Department, I hold an adjunct appointment in the SU Department of Science Teaching as well as maintaining

an appointment as associate director of the Evolution Education Research Centre, a joint involvement between McGill and Harvard universities.

My main research efforts continue to focus on the teaching and learning of evolution. In collaboration with colleagues at Johns Hopkins University, McGill University, and institutions in several Muslim countries, I am exploring how evolution is thought about and taught in Islamic cultures. This work is only part of my growing interest in evolution education on the international scale, including the vagaries of the provincial curricula in Canada. Finally, although my career has taken me to many interesting places, I keep my home state of Arkansas close to my heart. I have written on policy and politics around the teaching of evolution in Arkansas, and I continue to work with teachers and students in the state. Aside from research activities, I regularly return to Arkansas in conjunction with the Arkansas Governor's School on the campus of Hendrix College, and I was recently honored with an invitation to deliver the commencement address at the graduation ceremony of Ozarka College, not far from my childhood home. In a pull-quote from a front-page story in the Arkansas Democrat-Gazette about the Ozarka speech, I am reported to have said, "Do what you have a passion for, and the rest will fall into place." Whether or not I actually uttered those words, I'll stand by them. I love teaching biology, I'm passionate about my research, and I feel so very fortunate to be able to continue doing both at Syracuse.





## FACULTY/ALUMNUS PROFILE:

# Michael Cosgrove Ph.D. '98

I have always admired those who knew early on what they wanted to do with their lives. That wasn't the case for me, and it took me some time to discover science as my chosen profession. I grew up in the southern tier of New York State near Elmira, a town famous for being the final resting place for Samuel Clemens (Mark Twain) and for producing Syracuse University's only Heisman Trophy winner: Ernie Davis (nicknamed the "Elmira Express"). Davis was drafted by the Cleveland Browns but never played professional football because he was diagnosed with leukemia and died tragically shortly thereafter. I find it ironic that my relatively unguided interdisciplinary exploration has brought me from Elmira to Syracuse University, where I am studying a protein complex involved in the pathogenesis of leukemia. How I got to this point can best be characterized as a series of personal discoveries closely intertwined with the evolution of my self-awareness. I was a "late bloomer" emotionally and intellectually, which in the end, I think, has contributed to a much broader way of thinking than if I had been on one career track all along.

In high school in Elmira Heights, N.Y., I was more interested in sports than in science. I was the captain of the football, basketball and track teams, and won the Athlete of the Year award in my senior year. I played college football at SUNY Cortland until tearing the anterior cruciate ligament in my left knee in my sophomore year. Looking back, this unfortunate event was a turning point for me, as I became more serious about academics. I majored in mathematics and was on track to become a high school math teacher and coach. However, in my senior year in college, I took an introductory biology course and fell in love with it. I had never previously experienced such passion for learning. I then realized I wanted to do something related to biology, and knowing nothing about a scientific career, I thought I would become a medical doctor. This presented somewhat of a problem, as I had not completed most of the requirements for admission into medical school. I decided

to enroll in a master's degree program in nutrition science at Syracuse University, which I thought would help bolster my science credentials for medical school. I joined the laboratory of Dr. Pirkko Turkki, a nutritional biochemist who used erythrocyte enzyme assays to study human vitamin status. One evening standing alone in a dark corner in a laboratory in the basement of Bowne Hall, I initiated my first enzymatic activity assay and watched with wonder as a needle jumped across the paper of a chart recorder on an old Gilford spectrophotometer. I was amazed that I could actually watch the progress of a chemical reaction, and that enzymes could speed up those reactions so much. In that moment, I discovered scientific research, and knew that I would be a scientist.

I became interested in understanding how enzymes could achieve such rate enhancements of chemical reactions—on the order of at least a million fold—

under relatively mild conditions of temperature and pH. I decided after completing my master's degree to obtain a Ph.D., and I wanted to work on enzymes. I was intrigued by the research of Dick Levy, who studied enzyme mechanisms in the Department of Biology at Syracuse University. I decided to work with Dick on an enzyme that catalyzes the first committed step of the pentose phosphate pathway, glucose 6-phosphate dehydrogenase (G6PD). Most dehydrogenases use specifically either NAD<sup>+</sup> or NADP<sup>+</sup> as coenzymes. However, the enzyme from the bacterium *Leuconostoc mesenteroides* that Dick was studying is able to use either one. Dick was interested in understanding this curious evolutionary adaptation at the molecular level. Also, despite the importance of the reaction catalyzed by G6PD, its mechanism of rate enhancement had not been elucidated.

I embarked on a project to understand G6PD's catalytic mechanism, armed

only with an amino acid sequence alignment and the relatively new tool of site-directed mutagenesis, which allows one to replace an individual amino acid in the protein's structure with other amino acids, including those with different functional properties. The problem with this approach is knowing which amino acids, out of hundreds in a protein, to change. Conserved residues identified from sequence alignments of many G6PD's allowed us to make some educated guesses, but it wasn't until the three-dimensional structure of G6PD became available that we were really able to home in on the important amino acids in the structure. Dick had been collaborating with Margaret Adams from Oxford University on the structure of G6PD, which, after 12 years of effort, finally became available. This structure was another turning point in my career. I spent many spellbound hours looking at the three-dimensional structure of the enzyme using a computer graphics terminal. It is hard to describe the feelings; I was and still am struck with wonder when I look at a protein's structure. You begin to see how nature builds these elaborate and complex scaffolds to precisely align certain chemical groups, so that they are in the right position to distinguish minute structural differences on a substrate molecule. Examining molecular structure at the atomic level, it is easy to see how altering the position of an amino acid by as little as a few angstroms can have dramatic effects on the activity of an enzyme.

I obtained first hand experience in protein structure determination by spending a semester abroad in Margaret's laboratory at Oxford, where I resolved the atomic structure of a mutant form of G6PD bound to both glucose 6-phosphate and coenzyme product NADPH. Using this structure and other work, we were able to deduce that G6PDs use a highly conserved histidine-aspartate amino acid pair, reminiscent of the catalytic triad in serine proteases, to accelerate the chemical reaction catalyzed by G6PD by a factor of at least 100,000. It was amazing that these two amino acids, out of over 500 in the primary sequence of the protein, could have such a dramatic effect on the activity of the enzyme. Because of the evolutionarily conserved nature of these two amino acids, they most likely play a similar role in all G6PD orthologs found

in nature. This work illustrates the power of working at the interface between two distinct disciplines – enzymology and structural biology – a general theme that I think best characterizes my scientific career.

Looking back, I think that the small but diverse biology department at Syracuse University was the perfect place for me to begin a career working at the interface among various disciplines. Although I was trained in enzymology with Dick Levy, it was a course I took in developmental biology from Eleanor

the Department of Genetics at Johns Hopkins, with the goal of understanding the molecular underpinnings of gene silencing. Jef was one of the discoverers of ribosomal DNA (rDNA) silencing in yeast, and had several assays for rDNA, telomeric and mating type (HM) silencing set up in his laboratory. Using these assays, Jef's postdoc, Jeong Park, performed an unbiased genetic screen in yeast for histone H3 and H4 point mutations that resulted in the loss of rDNA, telomeric and HM loci silencing. I performed a structural analysis of these

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Maine that shaped what has become my independent career. I remember being intrigued by the famous “Chicken Tooth” experiment, in which embryologists Kollar and Fisher combined chick pharyngeal ectoderm (presumptive jaw) with mouse molar mesenchyme cells, resulting in the production of a chicken tooth. The mouse mesenchyme cells induced the expression of genes required for chicken tooth formation, a group of genes present but dormant in birds for approximately 70 million years. I became interested in understanding how a group of apparently functional genes required for tooth formation in birds could be held in a silenced state, somehow protected from random mutation, only to be reactivated by a missing factor(s) from the mouse mesenchyme cells. I wanted to understand the mechanisms of heritable gene silencing at the molecular level.

I decided in my postdoc to combine more in-depth investigations in structural biology with learning techniques to study gene silencing. After a short stint at Cornell University, I found the perfect place to combine these disciplines by joining Cynthia Wolberger's laboratory in the Department of Biophysics and Biophysical Chemistry at The Johns Hopkins School of Medicine. At the time, Cynthia was starting a collaboration with yeast geneticist Jef Boeke from

mutations and found they all mapped to a particular region of the nucleosome, the fundamental repeating unit of chromatin. Interestingly, we discovered that the mutations that were dominant mapped to three overlapping but distinct subsurfaces on the nucleosome that correlated with the distinct types of silencing in yeast. These results suggest that slightly different nucleosome surfaces are contacted by the three distinct proteins complexes that are required for the different forms of silencing in yeast. We published this paper in *Nature Genetics*, which highlighted a functionally significant role for the structural globular domains of histones in the regulation of gene silencing.

A nucleosome is composed of a disc-shaped octamer of histone proteins that wrap approximately 150 base pairs of genomic DNA. It is intuitively easy to understand that nucleosomes can regulate access to genes by wrapping DNA, and forming a steric block to transcription factors and RNA polymerase. Less clear is how nucleosome positioning on DNA is regulated. Recent studies demonstrate that nucleosomes are strategically positioned throughout genomes, and that even subtle changes in nucleosome positioning can have profound effects on gene expression. This raises the possibility that changes in



gene expression resulting from heritable alterations in nucleosome positioning could be involved in heritable silencing of genes, and the generation of new forms and functions at the organismal level. Moreover, such alterations independent of a DNA sequence change, i.e., epigenetic alterations, may be another source of variation acted upon by natural selection. An understanding of this process requires an understanding of how cells encode nucleosome-positioning information, and how that information may be inherited. One focus of research is the evolutionarily conserved histone proteins, the building blocks of nucleosomes; which, like DNA, are semi-conserved during DNA replication. Posttranslational modifications of histones provide a potential mechanism for the heritable transmission of epigenetic traits. Understanding how this process works is one of the central questions in biology today.

Evidence supporting a role for variation in nucleosome positioning in the generation of new forms and function at the organismal level comes from homeotic developmental defects resulting from the mutation of genes encoding enzymes that regulate nucleosome positioning. The term “homeotic” means “to change into the likeness of another,” which is exemplified by several bizarre phenotypes in organisms in the laboratory and in the wild. For example, in *Drosophila melanogaster* it has been demonstrated that misexpression of several HOX genes, genes required for segment identity in metazoans during embryonic development, results in the placement of legs, wings, or antennae in anatomical positions where they do not naturally occur. The temporal and spatial expression patterns of the *Hox* genes are heritably maintained by the antagonistic activities of the trithorax group and polycomb group proteins. Both groups contain enzymes, such as ATP-dependent nucleosome remodeling and histone modification enzymes that are required for maintenance of *Hox* gene expression patterns. Mutations in one particular member of this group occasionally results in a homeotic defect that produces three sets instead of the normal one set of wings on flies; it is called the trithorax (TRX) gene. In the early 1990s it was discovered that the human ortholog of the trithorax gene is frequently translocated in acute myeloid and lymphocytic leukemias, and

is therefore called the Mixed Lineage Leukemia or MLL gene. MLL and TRX each encode proteins that have a highly specific histone methyltransferase activity that is required for proper *Hox* gene expression patterns during metazoan development and hematopoiesis. In my laboratory here at Syracuse, we are interested in understanding the molecular mechanism that regulates the histone methyltransferase activity of MLL.

Despite the important role of MLL in development, stem cell differentiation and human cancer, relatively little is known about how it works. Part of this reflects the fact that MLL is remarkably complex; it is almost 4,000 amino acids in length, and it interacts with what is estimated to be over 30 proteins that regulate its activity. In addition, purification from mammalian cells has shown that the composition and enzymatic activity of the complex differs depending on which cell type it is derived from. In order to untangle this complexity, much of the early work in my lab has been to set up a well-controlled *in vitro* reconstitution system to understand the regulation of the histone methyltransferase activity of MLL. This has involved the cloning, expression and purification of several human proteins that are known to interact with MLL. In addition, because of the large size of MLL, we spent considerable effort identifying a minimal MLL construct that would be easier to work with in the laboratory. Despite the complexity of such an endeavor and the amount of time required to set up this system, it has turned out to be extremely robust, much better than I could ever have imagined, and has already yielded several surprising discoveries. Of course, this system never would have come into being if it weren't for the fearlessness of my postdoc Anamika Patel, who, despite the naysayers who said it couldn't be done, worked with Valarie Vought and my graduate student Venkat Dharmarajan to create a 5 component 200 kDa MLL core complex.

This experimental system will allow us to systematically address several important questions critical for understanding how histone methylation is regulated in the cell: What is the three dimensional structure of the complex? What protein surfaces are involved in the chemical steps of the reaction or in the assembly of the complex? How does the complex regulate the degree of

lysine methylation? To what extent is the variation in the enzymatic activity of MLL related to variation in form and function in the wild? Can this information be exploited for the rational design of new treatments for leukemia? We have already identified a novel class of peptides that disrupt a key protein-protein surface in the MLL complex, resulting in inhibition of the enzyme activity. We expect that these peptides or related small molecules could be used to epigenetically “reprogram” certain types of leukemia cells, helping them to return to a more normal state.

Our success has not been easy, as we have encountered many obstacles and setbacks along the way. But I believe we have benefited from the collegial and interactive environment at Syracuse within and outside the Department of Biology. The synergism created by scientists working at the interface between disciplines, often outside our comfort zones, provides opportunities for transcending discoveries. The richly diverse environment within the Department of Biology at Syracuse University has laid the foundation for my career of working at the interface among various disciplines.



## NEWHOUSE FACULTY/BIOLOGY ALUMNUS PROFILE:

Lawrence Mason, Jr. Ph.D. '79

**A**s I contemplate the 31 years that have elapsed since I completed my Ph.D. under Elias Balbinder, I'm reminded of a line from a Grateful Dead song, "What a long strange trip it's been." I could never have imagined that a molecular biologist, trained to work with the *Salmonella typhimurium* tryptophan operon, might morph into a globe-trotting teacher/photographer.

When I arrived in the Biology Department in the fall of 1973, a baby-faced, newly married kid of 21 from the University of Maine, I was assigned a teaching assistantship in BIO 121-123 working under Marvin Druger. One of the first people I met was David Schwartz, a fellow BIO 121 T.A. and a key member of Elias Balbinder's lab. David took me under his wing, helping me adjust to being a new teacher, and, as it turns out, proving to be a pretty good salesman for the research interests in the Balbinder lab. I quickly learned of Professor Balbinder's renown as a researcher and asked to join the team.

Our lab, complete with its colorful cast of characters, could have formed the basis of a sitcom something like the "Big Bang Theory." Besides "Dr. B," the lab was shaped by postdoctoral research fellow Hiroyuki Aono. Aono-san was a martial arts master who cooked a mean pot of sukiyaki and worked diligently to learn colloquial English by studying the Dictionary of American Slang. Then there was a doctoral student named Meg Dooley. We didn't see Meg all that much. She maintained a vampiric schedule, typically working from 10 or 11 p.m. until dawn. Next was the aforementioned David Schwartz, whose hilarious observations on the human condition might have propelled him into a career in stand-up comedy. Jerry Gayda was a Ph.D. student who joined the lab at the same time I did. He was a clean-cut Indiana farmboy who was an Olympic-caliber

firearms marksman. Jerry drove a souped-up Mustang that quite literally could burn one-eighth of a tank of gas just warming up in the Syracuse winters. Native Syracusan Peter Fear, whose name will ever be associated with the David Schwartz comment, "We have nothing to fear but Fear himself," rounded out the unusual bunch.

When "Dr. B" accepted a position at the AMC Cancer Research Center and Hospital in Lakewood, Colorado, in January 1976, he put Jerry Gayda and me on research assistantships and took us with him to continue our research in Denver. From a financial perspective, there ensued the toughest period of my life. Dr. B kindly arranged for Jerry and me to rent cottages on the grounds of the cancer research facility. My housing, security deposit, and health insurance were all paid to the research center through automatic withdrawal from my meager research assistantship pay. I will never forget the general hilarity, but personal distress, caused when I picked up my first paycheck. Inside the envelope was a printed check in the amount of -\$33. I never knew checks could be written for negative sums. Neither did the members of the office staff, who found this positively side-splitting. All I knew was that I had just worked for two weeks and owed money for the privilege. The Denver days were tough days indeed.

When the research support ran out, the director of the Cancer



Research Hospital offered me a part-time job. For \$5 an hour, I would be paid to move recently deceased patients to the basement morgue. Dr. Solomon Garb pointed out what a good deal this was since moving each body would only take 20 minutes, but the hospital would pay me for the full hour. "Um. No thank you." It was time to return to a Druger teaching assistantship in Syracuse to finish my research and writing. Moving dead fetal pigs seemed preferable.

"I wanted to become a teacher, and like my inspiration, Marvin Druger, I wanted to be a really good one."

At about this time, I came to the realization that my future was unlikely to be that of a bench scientist. I learned I was too social a creature to face, day after day, a lab bench covered with tubes of bacteria or tissue culture flasks. I wanted to become a teacher, and like my inspiration, Marvin Druger, I wanted to be a really good one. However, to be a university biology professor, I'd be tied to the whims of the NIH and NSF. I had to consider alternate possibilities.

Back in Syracuse in the summer of 1978, with the gracious permission of my substitute advisor, Ralph Slepecky, I enrolled in PHO 555 (Photography for Newspaper and Magazine) in the S.I. Newhouse School of Public Communications. Photography had been a hobby of mine since the age of seven, when my dad began sharing his hobby with me. I could not have prepared myself for the explosion of realizations that came my way in PHO 555. My teacher, Dr. Thomas Richards, became another of my great inspirations. He even served as the Graduate School representative on my doctoral defense committee in December of 1979. Within the 14 weeks of that course, I literally saw all my possibilities start to align. I loved everything about photography. The shooting part involved the social side of life I craved. The

technical part was a snap for someone with the chemistry, math and scientific skills I possessed. For me, it provided the perfect blend of everything I was.

In December of 1979, David Schwartz and I passed our doctoral defenses. Just three semesters later, in May of 1981, I completed the coursework for a master's degree in communications photography. My transformation was complete.

I started selling freelance photography work during my first photography class. A news feature I shot in 1978 was sold to United Press International for \$15. It related to the birth of the first test tube baby, Louise Brown, in England. Shot in the Biological Research Laboratory (BRL), the picture featured the young daughter of biology grad student John Philip, peering over her glasses, scrutinizing a test tube of liquid. I was hooked and quickly became a regular freelancer for UPI, eventually becoming the Central New York picture coordinator for the wire service, and spending time as a staff photographer and picture editor for the *Syracuse Herald Journal* newspaper.

Working for UPI, I photographed everything from U.S. presidents to rock stars to championship sporting events. On one assignment, shooting a Monday Night Football game at Buffalo's Rich Stadium, I was asked to concentrate on the Denver Broncos' quarterback, John Elway. That evening, Elway, one of my sports heroes, engineered a masterpiece victory against the Buffalo Bills. One of my pictures of him ran in many of the nation's top newspapers the next morning.

I recall quite clearly the day when I knew unequivocally that my career evolution had been right for me. In the mid-1980s, I landed a summer job to tide me over through my summer break from the University. I became a contract photographer for the Jamaica Tourist Board. Along with David Grunfeld, a photographer friend who had been a student of mine, I went to Jamaica for about five weeks, making photographs that would be used to promote tourism in the Caribbean nation. On a perfect summer day, we were taken to the remote Reach Falls in the jungle near the tiny town of Manchioneal. Our assignment was to photograph the exquisite Miss Jamaica in the gushing waterfall. David and I shared a glance. Neither of us needed words. We found ourselves in a "beer commercial moment." You know, the one in which someone hoists a frosty beer and enthuses, "It doesn't get any

better than this!"

The Jamaica trip was so much more than that one glorious day. We photographed Reggae Sunsplash in Montego Bay, staying at the same hotel as Bob Marley's widow, Rita. We photographed landscapes from above while gliding in a hot air balloon. David and I enjoyed a raft trip down the Rio Grande river, an activity popularized by Errol Flynn. We even photographed Errol Flynn's widow. We stayed at the top hotels on the island and ate at the best restaurants. An irony in all this is that after a couple weeks of incredible surf-and-turf dinners, all we craved was a simple, but delicious, hot turkey sub from Zorba's on South Crouse Avenue in Syracuse. I still dream about those perfect subs. Zorba's closed many years ago to make way for a parking garage.

For the last 28 years, I've been a professor in the S.I. Newhouse School of Public Communications at Syracuse University, where I hold a dual appointment in the Departments of Communications and Multimedia, Photography & Design. The story of my hiring at the world-renowned Newhouse School reads as a most improbable series of "lucky" moments. In March 1981, while finishing coursework for my master's degree in communications photography, I applied for a one-year renewable contract teaching photography within the school. Actually, I didn't complete a master's thesis and receive my degree in communications photography for several more years. However, I did have a doctorate, albeit in molecular biology. I was offered the position. In March of 1982, while photographing an SU basketball game at the Carrier Dome, the director of photography at the Syracuse Newspapers, shooting next to me, inquired about my availability to become the picture editor at the *Syracuse Herald-Journal*. I declined his kind offer. About a week later, the school and I learned that the funding that made my photography teaching position possible would unexpectedly run out at the end of that semester. My dream job would come to a screeching halt. I called my friend at the *Herald-Journal* and asked if his offer was still open. In late May, I began my new job at the newspaper. That July, the dean of the Newhouse School contacted me to ask if I was willing to return. There was still no funding for me to teach photography, but there was an open position teaching Introduction to Mass Communications. Apparently,

I was qualified because I worked as a radio broadcaster at two stations in Maine through high school and college, and because I had worked in photography for a wire service, a newspaper and a couple of magazines. Clearly, a bit of faith factored into my “qualifications.” Although I knew little about advertising, public relations and television, I’ve always been a quick study, and I had about five weeks until the start of the fall semester. I took the job.

Now almost three decades after my first teaching semester, I’m a tenured full professor and one of the senior faculty members in the Newhouse School. I’ve taught over 9,000 students, including a great many who have gone on to significant achievements in their media careers; quite a few are widely known by the general public. I’ve received honors as a teacher, including the Syracuse University Student Government Association Teacher of the Year Award. Later, along with my friend Marvin Druger, I was selected by SU as one of the Gateway Teaching Fellows, a group of 13 outstanding teachers dedicated to teaching lower-division students. Indeed, the circle is complete: I’ve become the Marvin Druger of the Newhouse School.

For 40 years or so, the Newhouse School has maintained a fall photojournalism study abroad program in London. One of the great privileges of teaching photography at SU is that our faculty have run the teaching of that overseas program. Each of us expects to teach in London every four or five years, and my initial rotation began in 1991. As I write this in 2010, I’ve taught five semesters in London and am preparing to teach my sixth in the fall. All that time in London has only enhanced my appreciation for the place. In 2005, I created, and continue to direct, a summer fashion photography program that takes advantage of London’s position as one of the top four fashion capitals of the world. I’ve taught four summer sessions there and forged an educational partnership with Condé Nast International, the worldwide publisher of *Vogue*, *GQ* and *Vanity Fair*.

Back when I worked in Elias Balbinder’s lab in Denver, I delved into a hobby I first learned from my mother. I have always had an interest in growing tropical plants, even raising a couple in the BRL rooftop greenhouse in the vacant spaces between Prof. Sam McNaughton’s

experiments on the ecology of East African grasslands. In Denver, I befriended the director of the Denver Botanic Gardens, Andrew Pierce, and one of his workers, Gary Davis. Through their sharing of cuttings and trading plants, I soon acquired a startling collection of rare and unusual vegetation that grew happily in my cottage at the cancer research center. Years later, on a family trip to San Diego, I purchased a potted dwarf banana tree and carefully carried it back to Syracuse through a succession of overhead luggage compartments on

“I picked up my first paycheck. Inside the envelope was a printed check in the amount of -\$33. I never knew checks could be written for negative sums.”

flights to San Francisco, Seattle, Chicago and Syracuse. Somehow, the delicate plant survived the trip, forcing me to do what any other self-respecting tropical plant grower would have done. I built a greenhouse behind my house and planted the banana tree in it.

Four years later, I had a thriving seven-foot-tall banana tree that bloomed. My organic banana crop started to ripen during late February of 1994, as it happened, while Syracuse was in the midst of a deep freeze bottoming out at minus 23 degrees Fahrenheit. This sort of thing is newsworthy in Syracuse. I became the subject of a feature story titled “Going Bananas” in the Sunday *Syracuse Herald American* newspaper.

There is something irresistible about bananas that cost about \$1,000 a pound to grow. I was contacted by the head of programming for the fledgling Home and Garden Television Network and asked to write and host a program called “Winter Gardening.” The show, produced by colleagues at the Newhouse School of Public Communications and shot in my backyard greenhouse, debuted when the network began on cable in December 1994.

Somehow, I became a minor television personality. When one of my Newhouse colleagues routinely calls me a pioneer in cable television, I shrug off the compliment but realize that it is true. I was one of a small group of early TV hosts on HGTV that included Willard Scott, John Ratzenberger and Joy Philbin. I received viewer mail from all across the country, including a memorable letter from a woman in Hilo, Hawaii, asking my advice about growing banana trees. It was, I believed, a sign the apocalypse was upon us when a viewer who lived in the greatest tropical growing climate in the country sought banana-growing advice from a guy in Syracuse.

“Winter Gardening” lasted five years on HGTV before going into syndication on the DIY network, also owned by Scripps Broadcasting. The show was available in 50 million U.S. homes by 1999, when we wrapped production. If not for my time in Denver and my strange act of devotion to a potted banana tree, I see no way I would have been asked to write and host a national television program years later.

Shortly before Christmas 1988, a terrorist bomb ripped apart Pan Am Flight 103 in the skies over Scotland, killing all 259 passengers and crew and another 11 victims on the ground in Lockerbie. The plane carried 35 SU students, including eight I had taught in COM 107 (Communications and Society), two of whom I had come to know very well. My curiosity about Lockerbie led me to visit in the fall of 1996, one of the semesters when I taught in London. My wife and I took our son Jonny and all 16 of my photography students on a weekend field trip to Scotland. Saturday afternoon was spent in Lockerbie taking in the main disaster sites. Our tour ended with the Garden of Remembrance in Dryfesdale Cemetery, within which a granite wall bears the names of all Flight 103 victims. Despite my students having



no direct connection to the disaster, we all cried during that afternoon. We also photographed what we saw.

I came to realize that we saw a very tightly edited view of Lockerbie during that visit. The tour was built around the anticipated needs of a group of Syracuse University students and faculty. We saw disaster sites but almost nothing of the town. This was understandable since the local people had never witnessed much interest in anything other than disaster sites by any of the post-Flight 103 visitors. I began to realize that my band of photographers could add little to anyone's understanding of the Flight 103 disaster eight years after it happened. But I also realized there was a broader story that had gone untold, the story of Lockerbie itself.

In the fall of 1999, I taught in London again and returned to Lockerbie with my photography class, this time for the whole weekend. We stayed with local families who agreed to help their visitors experience Lockerbie from the standpoint of the locals. We began to shape the story of Lockerbie involving over a thousand years of its colorful past and present. That visit led to my writing a grant proposal that funded several more trips to Lockerbie with Melissa Chessher, a Newhouse School colleague of mine and over 50 student photographers and reporters. We received donations of film from Eastman Kodak, Fujifilm, and many American newspapers. The grant-supported visits lasted for several years. My personal visits lasted for four more years while I journeyed north from London while teaching summer courses in fashion photography there.

In November of 2008, in recognition of the 20th anniversary of the Pan Am Flight 103 disaster, I published *Looking for Lockerbie*. It is a 248-page, coffee table book featuring my work in eight written stories and 100 photographs, coupled with 154 student photographs and writing by Melissa Chessher and students. Never has the small town of Lockerbie received this much visual scrutiny. Over 40,000 photographic frames were shot in the 12 years of information-gathering for the book. Our book designer was a brilliant and talented design editor at *National Geographic*, who happened to have very specific links both to me and to the Syracuse University Biology Department. Sean McNaughton is the son of biology professor Sam McNaughton and a former colleague of mine in the S.I. Newhouse

School of Public Communications.

*Looking for Lockerbie* met with instant praise from a variety of sources. The London *Independent* named our book "the pick of the picture books." Samantha Brown, host of "Passport to Europe" on the Travel Channel, wrote, "I plunged into *Looking for Lockerbie*, emerging later feeling like I had taken a most refreshing walk in the hills of Scotland." The Glasgow *Daily Record* called the book "...poignant, stunning, vivid..." All profits from the book support a scholarship fund in Lockerbie that sends two students each year to study at Syracuse University. The book is available at the SU Bookstore or at a substantial discount from Amazon.com.

In her profile for BIO@SU, Ahna Skop quotes the late Prof. Kevin VanDoren, "I may never be a great scientist, but I am a great dad." That comment really stuck with me because I feel the same way. My wife Elaine and I have been married for 37 years. We've raised two wonderful sons, both of whom graduated from Syracuse University. Tom, the older one, was a dual major in television, radio and film, and history. Four years ago, he gave us a daughter-in-law when he married the lovely Jackie Lasek from Philadelphia. Tom is a documentary film and television producer, videographer and editor and teaches documentary television production at Columbia University. My younger son, Jonny, was a triple major at SU in television, radio and film; history; and political science. He worked in film special effects, taught English in Shanghai, China, and just completed an MBA degree. Jonny is launching a business in India and New York this summer.

For this profile to have meaning beyond what must seem to some of you as random entertainment, I should close with some lessons learned. I've learned that each of us is the unique product of everyone and everything we've ever experienced. My parents taught me to follow my heart. My family taught me to treasure moments both big and small and to smile in the face of adversity. Long ago, Ray Bradbury taught me to dream beyond horizons. My Biology Department mentors taught me to be curious and to dig for answers. They also taught me the value of perfectionism. No one will ever care more about your work than you do. Photography taught me to have fun at work, because when you do, you never

feel like you are working. Journalism taught me not to sacrifice accuracy under the looming pressure of deadlines. My Quaker upbringing taught me to try to view things from other people's perspectives. Traveling widely has only strengthened this resolve. Lockerbie taught me the depth of the capacity for healing in the human heart. Both of my universities presented opportunities for breadth of experiences. They encouraged my belief that a good education can prepare you to walk through any door. After all, a random ornamental horticulture course at the University of Maine led to an affiliation with the Denver Botanic Gardens, which led to "Winter Gardening." My best teachers, including Marvin Druger, taught me how to share with others what I learned along the way. Yes, it has been a long, strange trip, but it's been a fantastic trip; and I can truly say I wouldn't have done any of it differently. At the age of 58, I still believe the best is yet to come.

## GRADUATE STUDENT PROFILE:

# Aditya Dutta

There are two things that have always fascinated me—airplanes and living organisms. Growing up involved a conflict between digging in the soil for little worms and insects only to be interrupted by an aircraft in the sky. I am a native of India, and there were clear expectations for me (as is the case with most Indian children) to become either a medical doctor or an engineer. I was never much interested in what engineers did, and the sight of blood made me dizzy. However, biology, a natural science, caught my fancy pretty early. Advanced level biology courses, a terrific high school teacher, and all those dissections not only furthered my interest but also convinced me to opt for a biology-related discipline in college. For my B.S., I opted for a biochemistry major with honors from the University of Delhi at New Delhi, India. I was then awarded a post-baccalaureate National Research Fellowship by the Department of Biotechnology, Government of India. I pursued an M.S. in biotechnology from the Indian Institute of Technology Bombay at Mumbai, India. My master's research topic involved the study of regulation of sporulation in *Bacillus subtilis*, a model gram-positive bacterium. During my work, I was introduced to the power of molecular biology tools. These allowed me to modulate conditions within a cell and to assay for the effect of the introduced change. I thought about all the awesome things that I could do now that I could change how a cell was functioning and even fix noncompliant cells. This idea was extremely fascinating and prompted me to pursue a Ph.D. During this same time, I was awarded a predoctoral National Research Fellowship by the government of India, which allowed me to pursue my Ph.D. in India, and was also simultaneously accepted into Ph.D. programs at different institutions in the U.S. There were a couple of reasons that made me prefer a position in the U.S.—an opportunity to travel to another country and a greater exposure to cutting-edge science. Syracuse University was my school of choice given its early acceptance and location in the northeastern U.S. I joined Dr. Ramesh Raina's laboratory for my doctoral work.

Research in the Raina lab is focused on better understanding the interaction between plants and pathogens at the genetic and molecular level. When plants interact with pathogens, it leads to either the plant mounting a defense response against the pathogen and clearing it out or the pathogen causing disease and taking over the plant. These two opposite scenarios are associated with modulation of a variety of cellular processes, which we in the Raina lab try to identify and study at the molecular level. Identification and characterization of these regulation nodes may allow us to develop commercial crops better able to withstand pathogens, and more effectively deal with other biotic and abiotic stresses.



The specific aims of my research are to characterize the role of three genes of *Arabidopsis thaliana* involved in regulating pathogen defense. *Arabidopsis* is a model plant extensively used in studying a variety of plant processes. It has the advantage of small size, short life cycle (seed to seed in about six weeks), high fecundity (about 10,000 seeds produced per plant), ability to be crossed or self-fertilized, and a sequenced genome.

One of my projects involves cloning and characterization of the *HRL1* (Hypersensitive Response-like Lesion I) gene of *Arabidopsis*. A lesion-mimic mutant (*hrl1-1*) of this gene has been identified and characterized in our lab. (A mimic mutant is one that mimics the diseased state in a plant independent of pathogen presence.) The *hrl1-1* mutant is smaller in size, displays spontaneous lesions (Figure 1), and is more resistant to pathogens compared to the wild type Col-0.



**Figure 1:** Phenotypes of 6-week-old (a) wild-type Col-0, (b) *hrl1-1* mutant and (c) close-up of *hrl1-1* leaves showing characteristic lesions with progressing age.

To clone the *HRL1* gene, we employed a map-based cloning approach. The region containing the *HRL1* gene was mapped to a 34 kb genomic fragment. One of the sub-clones (~5 kb) of this fragment successfully complemented all three characteristics (listed above) of the *hrl1-1* mutant, suggesting that it contained the *HRL1* gene. Sequencing of this ~5 kb fragment revealed that *HRL1* codes for a poly-prenyl transferase involved in a crucial step in the biosynthesis of ubiquinone. We also determined that the mutation *hrl1-1* resulted in the substitution of lysine for phenylalanine at a conserved residue in the enzyme.

To further characterize the function of *HRL1* protein in pathogen defense, transgenic plants constitutively over-expressing the *HRL1* gene were constructed. We found over-expression lines were 12- to 14-fold more susceptible to virulent bacterial pathogens, and 4- to 5-fold more susceptible to avirulent bacterial pathogens compared to the wild-type Col-0. *HRL1* over-expression lines were also found to be less sensitive to paraquat, a chemical that produces reactive oxygen species (ROS). ROS are key signaling molecules in the plant defense response. Over expression of *HRL1* may lead to higher production of ubiquinone (given its role in ubiquinone biosynthesis), which in turn may play a role in more efficient detoxification of ROS. Mitochondrial fractions from the *HRL1* over-expression line and wild type Col-0 will be isolated, followed by quantification of ubiquinone levels in these plants. Further oxidation-reduction states of ubiquinone in these plants will also be assayed. This study is significant because it allows us a greater understanding of the role of ROS in plant basal resistance.



My second project is a characterization of a histone demethylase involved in epigenetic regulation. This study identifies the first such enzyme associated with plant defense.

My third project involves the study of an unknown gene involved in the salicylic acid (a key signaling molecule) mediated

defense pathway. This study identifies a novel signaling pathway in plant defense.

The work described above should help us better understand the role of these genes in plant defense. Knowledge gained from these studies can be extended to crop plants to develop cultivars with enhanced resistance to pathogens. In addition, these

studies should help us better understand molecular mechanisms regulating gene expression in a variety of biological processes in several organisms, including humans.

## GRADUATE STUDENT PROFILE:

### Stephanie Eby

According to my parents, my love of animals started at the age of 3 when they let me give apples to the horses in the paddock, next to the bus stop, up the street from where we were living. While I don't actually remember doing this, I do remember around the same time staying at a bed and breakfast whose owners had four horses and three teenage girls. The girls took me out to the field to meet the horses, and one of the horses even pretended that he was going to eat the breakfast I wouldn't eat. By the age of 8, I had convinced my parents to allow me to take riding lessons, and I spent hours at the barn riding horses, grooming horses, and mucking out stalls.

One day when I was in high school, I was up in the hayloft of the barn, and I looked out to see one of the horses lying on the ground. Worried that something was wrong, I ran out to the paddock to find her giving birth to a colt. While the whole experience was beautiful, I felt so helpless that I decided right then that I was going to be a veterinarian. For the first two and a half years of my undergraduate education at Bates College in Lewiston, Maine, I took all the necessary courses for veterinary school and spent my summers volunteering at veterinary hospitals. However, my plans to be a veterinarian ended during spring semester of my junior year. Ever since middle school, when I saw a television show about the wildebeest migration that occurs in the Serengeti-Mara ecosystem in Tanzania and Kenya, I wanted to travel to Africa. In my junior year I spent a semester abroad at the School for Field Studies Center for Wildlife Management in Kenya. I can still remember landing at Nairobi airport,

jetlagged after having spent a 12-hour layover in London, and driving to our first field camp. Shortly after we left the airport, I saw my first giraffe in the wild, and I was hooked.

As part of the program, we took classes on wildlife management, wildlife ecology, and environmental policy. The course work was supplemented with field trips to various parks, giving us the opportunity to witness in person what was being taught in the classroom. The end of the program consisted of a directed research project where we split up into three groups, each studying different aspects of the topics we had been discussing all semester. My group worked in Nairobi National Park identifying and counting grass species. Despite my initial belief that counting grasses would be boring, I loved the field work and decided that research was for me.

Upon returning to Bates, I spent the summer and my senior year conducting studies on the mating display and escape behavior of guppies as part of a senior

thesis in biology. Still loving research, but not yet ready to go back to school, I spent two years working at Massachusetts General Hospital on the genetics of cardiac disease using zebrafish as a model organism. Eventually, I concluded that bench research was not for me, but I also realized it would be hard to get a field job without further education. Therefore, I applied for Ph.D. programs, hoping to do field research in an African country.

Sometime after my application was submitted to Syracuse University, I received an e-mail from Professor Mark Ritchie informing me that he was interested in having me join his lab. He had just received funding for a project to be conducted in Serengeti National Park, Tanzania, the same place where the television show on the wildebeest migration had been filmed. He had seen in my application that I had studied abroad in Kenya and thought I would be a good fit for the project.



The summer before I started my studies at SU, I attended a meeting in the Serengeti for the park management and past, present, and future researchers. While there I heard many talks about research that had been and was being conducted in the park. I also found out about the research areas that interested the park managers and management questions that needed to be answered. One tool park managers used was fire; however, it became clear to me that no

one was studying the impacts of the fire management program on the ecosystem.

Park managers in the Serengeti intentionally light fires and normally burn over one-third of the park each year. Although there are multiple reasons for burning, the main ones are to ensure that the grass does not get moribund and to keep fires outside the park from coming in and destroying large sections of the ecosystem. My doctoral research focused on how these management-set fires impact the distributions of herbivores and carnivores in the post fire landscape.

I discovered that Thomson's gazelles, wildebeest, impala, warthog, and Grant's gazelles are attracted to burned areas for the first six months following a fire. The reason for this attraction appears to be twofold. First, the herbivores are attracted to the new plant growth which sprouts after burning. This plant growth is higher in nutrients than unburned plant material. Second, burning decreases vegetation height, thereby increasing sighting distances and reducing cover, making it harder for carnivores to sneak up on the herbivores. This makes burned areas safer

habitats for herbivores to reside.

One of my favorite studies involved the use of a life-sized stuffed cheetah (named Isabella Jane by my then 4-year-old neighbor) and her effects on Thomson's gazelles.

The amount of time individuals or a group of animals spend looking (being vigilant) is often considered an indicator of habitat safety. I wanted to test if there were differences in the group vigilance levels (proportion of the group vigilant) of Thomson's gazelles between burned and unburned areas before and after the introduction and removal of Isabella to the area. I expected to find lower vigilance levels in burned areas compared to unburned areas because one potential reason for herbivore attraction to burned areas is that they might be safer habitats. I also predicted that after the introduction and removal of Isabella from an area, Thomson's gazelles' vigilance would return to pre-Isabella levels faster in burned areas than in unburned areas.

One of the exciting but frustrating things about science is that things don't always work the way you thought they would. I found that before the introduction of Isabella to an area there was actually no difference in vigilance levels between burned and unburned areas despite my initial prediction that there would be. However, as I predicted, after her introduction and removal, vigilance levels returned to pre-introduction levels faster in burned areas than in unburned areas. This seems to indicate that after a predator has been in an area, Thomson's gazelles feel safer in burned areas than in unburned areas.

As I finish writing my dissertation and look forward to the next step in my career, I have fond memories of my time in the Serengeti. I can't believe how lucky I was to get to work and live in such an amazing place. All told, I made five trips to Tanzania. My last trip there was a four-day visit made specifically so that I could present my findings to the park management. These findings will enable them to make more informed decisions about their burning program. Should you ever have a chance to visit the Serengeti, go; it is an experience you will never forget.



Isabella the cheetah



Thomson's gazelle



## GRADUATE STUDENT PROFILE:

# Nicole Jacobs

When I was an 8-year-old, I wanted to be one of three things when I grew up: a doctor, a Broadway dancer, or a teacher. Then I watched an episode of 20/20 in which they broadcast a live surgery; I decided I did not want to be a doctor anymore. Dance was my passion all through high school. It made me happy, and I wanted to pursue it as a career. But as I began looking at colleges, I realized there was incredible competition in the world of performing arts. I gave up my ambition to dance on Broadway and concluded dance would make me happier as a hobby, where I could dance for the joy of dancing rather than as a means to make a living. My feelings about teaching, on the other hand, have not changed much. I first decided to pursue a career as an elementary school teacher, then shifted my attention to high school teaching, but eventually decided to become a college professor. As for my love of science, I think it was always there; it just took some advising from others before I realized it and connected my interest in science to teaching.



My first biology course was an eighth-grade Regents class. My biology teacher was a unique person, and one of the wisest, most interesting people I have ever known. At the time, my aspiration was still to dance on Broadway. This particular teacher kept telling me, in his words, “not to waste my intellectual talent.” I needed to go to school to be a scientist... or something, anything, other than dance. And of course I disagreed. It was not until my high school academic advisor reinforced his message during my senior year that I began to change my mind. I was taking classes at the local community college through a program my high school offered for seniors. This advisor looked at my grades and told me I should go into math or the sciences. After an hour, she convinced me I should study biology.

From that point onward, I became more and more enveloped in my studies. I graduated high school and entered college at the University at Buffalo as a biology major. There, I excelled in all my science classes. The more I learned, the more interested I became. During my final year at the University at Buffalo, I worked in Dr. Kiong Ho's laboratory. It was there that my career in scientific research began. I completed my degree in three years. The fall after graduation I began graduate school in the Biology Department at Syracuse University. Graduate school was a completely different experience for me

than my undergraduate career. At first I was intimidated, not sure if I would be successful. As I began meeting more people and learned more about the department, I started feeling comfortable, and I soon began to realize I had made the right choice; this was the place that I belonged.

Graduate students in the Biology Department usually complete three laboratory rotations during their initial year. I studied first in the laboratory of Dr. Eleanor Maine and then in that of Dr. Melissa Pepling. During my second semester, I enrolled in a seminar class taught by Dr. R. Craig Albertson and found I was very interested in his work, so I asked him to allow me to complete my final rotation in his lab. In the seminar course, I was required to select my own topic and write a research paper. I decided I would investigate the etiology of human scoliosis. I was especially interested in this topic because I was diagnosed with the disease as a child and wore a backbrace for three years to help correct my spinal curvature. The doctors told my family and me the disease had a genetic mode of inheritance, but to our knowledge, no one else in my immediate or extended family has had scoliosis. I was curious as to how scoliosis came about and wanted to know how I ended up with it.

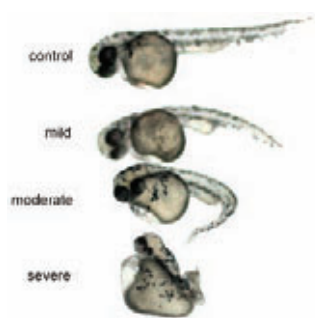
After much research, all the information I found described possible secondary symptoms of the spinal

curvature described as scoliosis, rather than the primary cause. I quickly discovered the onset of scoliosis in an otherwise healthy individual was idiopathic in nature, meaning the cause was unknown. After reading my inconclusive paper, Professor Albertson suggested to me that I consider working on a dissertation project elucidating the etiologies of spinal deformities in his lab. After careful consideration, I decided this was a topic I was genuinely interested in and passionate about, and an opportunity I could not pass up.

My research in Professor Albertson's lab focuses on two genes, both members of the Chromodomain Helicase DNA Binding Protein (CHD) family, a group of ATP-dependent chromatin remodelers. Chromatin remodelers are important proteins involved in the modulation of DNA structure and DNA-nucleosome interactions. *Chromodomain helicase DNA binding protein 7 (chd7)* and *chd2* were recently implicated in spinal deformities in humans and mice, but little is known about the roles these genes play during spine development. Development of the spine begins with somitogenesis, the process of formation of the somites, which are balls of tissue that are precursors to the vertebrae, among other structures. The goals of my dissertation research are to: 1) determine the roles of Chd7 and Chd2 in somitogenesis and patterning of the axial skeleton, and 2) identify other factors or signaling

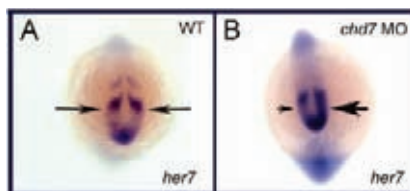
networks that interact with Chd7 and Chd2 during development, using the zebrafish, *Danio rerio*, as a model system.

Using morpholino antisense technology, I knocked down *chd7* and *chd2* expression. This technology involves injection of early zebrafish embryos with short oligonucleotides complementary to the mRNA of interest. The oligonucleotides bind the RNA of interest, preventing it from being translated correctly into its corresponding protein. My preliminary data show knockdown of *chd7* and *chd2* expression produces a range of phenotypes in zebrafish, including curvature of the long axis of the body and pericardial edema (Figure 1).



**Figure 1:** Representatives of the range of phenotypes that occur in zebrafish injected with *chd7* antisense morpholino. The fish labeled “control” is an example of a fish injected with a morpholino that does not bind any RNA specifically, and is used to control for the process of injecting. The three other fish are examples of fish phenotypically classified as having “mild,” “moderate,” or “severe” defects due to *chd7* knockdown. All the zebrafish pictured here are 2 days old.

Several genes involved in somitogenesis, normally expressed in a symmetric fashion in the somites and tailbud, exhibit patterns of asymmetry in zebrafish embryos with knocked down *chd7* expression (Figure 2). Therefore, it seems Chd7 and Chd2 may play significant roles in the process of somitogenesis in zebrafish.



**Figure 2:** *Her7* is a somitogenesis gene involved in directing the development of individual somite pairs. Normal *her7* expression occurs symmetrically in each somite pair as it forms and in the growing tailbud. Asymmetric expression of *her7* is exhibited in the tailbud of *chd7* morpholino injected embryos (B, large arrow), but not in wild type embryos, providing evidence that Chd7 may be important in the regulation of *her7* during somitogenesis in zebrafish.

In addition, because Chd7 and Chd2 are chromatin remodelers, it is likely these proteins will have multiple genetic interactions beyond those specifically involved in somitogenesis. For example, mutations in members of the CHD family are linked to neuroblastoma development, small cell lung cancer, and the debilitating human disorder CHARGE (coloboma of the eye, heart defects, atresia of the choanae, retardation of growth, genital abnormalities, ear abnormalities and deafness) Syndrome. My research will also involve the determination of potential genetic interactions involving Chd7 and Chd2 during zebrafish development outside of somitogenesis.

Knowledge obtained from my work is directly relevant to human health and disease. I hope the information acquired through my dissertation work regarding Chd7 and Chd2 function may offer molecular inroads into the etiology and pathophysiology of human spinal deformities and help identify additional factors that interact with Chd7 and Chd2, as well as contribute to the clarification of global roles for chromatin remodelers during development.

Beyond my dissertation work, I have been privileged to serve as a teaching assistant for several different undergraduate classes offered by the Department of Biology. As a member of the Future Professoriate Program, I have also developed and taught my own undergraduate seminar course, Emerging Topics in Biology, the past

two spring semesters. Through these experiences, I have discovered that to teach well, you must learn not only the course material but also how to teach to different types of students in a manner that is interesting and motivational but still content rich. Teaching has allowed me to meet many different people with a plethora of backgrounds, experiences, abilities, and methods of learning. It has been extremely rewarding

“I hope the information acquired through my dissertation work regarding Chd7 and Chd2 function may offer molecular inroads into the etiology and pathophysiology of human spinal deformities and help identify additional factors that interact with Chd7 and Chd2”

watching my students grow over the course of a semester, as their spheres of knowledge expand and they are able to make connections between classroom material and current world events. With aspirations to become a faculty member in the future, teaching has helped me to become a well-rounded graduate student, a better researcher, and a better person.

It has been an amazing experience getting to this point in my life, and I have many people to thank for helping me along the way. My graduate studies at Syracuse University have provided me with the foundation for success that will always be a part of me. I am appreciative and plan to take full advantage of that in the future. After all, this is only the beginning.



## UNDERGRADUATE STUDENT PROFILE:

### Kali Henn

I was exposed to research at a very early age because both my parents are involved in animal care and studies at Syracuse University. I can vividly remember pleading with them to let me see the mice, rats, and rabbits that frequented the lab. My interest in research escalated during my junior year of college when I enrolled in the class Animal Behavior and Evolution taught by professors Scott Pitnick and Al Uy. At the first meeting, the class was informed that we would go into the field and each of us would be responsible for developing a research question or project. We would then design and run experiments to answer that question and subsequently present our results in a formal manuscript. To someone who had never actually done any research, it felt like a daunting task, but one that I was eager to try.

On our first trip, the class walked along nature trails on the outskirts of various fields. We eventually stumbled upon an insect, the ambush bug (*Phymata americana*), which, unbeknownst to me at the time, would become the focus of my undergraduate research. I did some preliminary research on this insect for my class project, but ambush bugs are seasonal insects and I found myself forced to postpone the project until a later date. As the semester came to an end, I volunteered to complete a study on the yellow dung fly (*Scathophaga stercoraria*), which had been initiated as a class project. Yellow dung fly males aggressively compete for access to receptive gravid females on fresh dung. The larger males are more successful at acquiring mates and completing copulation. We demonstrated that when an alternative food resource is available, such as apple pomace, some females aggregate there, and smaller males will redirect their mating attempts to the new substrate. Therefore, a mating advantage exists for smaller males on pomace, supporting the idea of an alternative male reproductive tactic in this species. I also worked with graduate student Dawn Higginson studying sperm conjugation in the diving beetle (*Graphoderus liberus*).

With the return of the ambush bug season, I was able to begin experimenting and collecting data related to my original interest. The ambush bug, as its name implies, is an ambush predator that sits and waits for prey on inflorescences, in this case, of golden rod (*Solidago spp.*). The insects are difficult to find because they are scattered over a wide area and their coloration provides excellent

camouflage on yellow flowers. As a result, I frequently found myself dragging my dad, sister, and the occasional friend out into the field in an endless search for sufficient numbers of ambush bugs.

A preliminary portion of my research dealt with ambush bug distributions across the goldenrod inflorescences they inhabited. These data provided me with a better understanding of how widely dispersed the insects were, whether a male/female biased sex ratio existed, and, directly relevant to my research, the frequency of a phenomenon called “mate-guarding” displayed by males. Unlike most insects, ambush bugs engage in prolonged precopulatory, copulatory and postcopulatory associations between the sexes; this is mate-guarding, and I am interested in its adaptive significance. It is hypothesized that the males guard the females to prevent the latter from mating with other males, thereby diluting the contribution of sperm from the guarding male. When observing ambush bugs in nature, one often finds males sitting atop the female’s back. This mate-guarding position is quite different from the copulatory position where the male is positioned lateroventrally to the female with genitalia engaged. Although observation of mate-guarding is unmistakable to the naked eye, it is not possible to distinguish between precopulatory guarding and postcopulatory guarding in the field. The only way to accurately differentiate between guarding phases is to observe the pair from formation to separation, a difficult task in their natural environment.

To address the hypothesis that males

guard females to prevent them from mating with other males, I needed to first establish that female ambush bugs would, given the opportunity, mate with multiple males; otherwise guarding would not make sense. This proved to be true, as all females in the experiment mated again if I removed the initial male. The subsequent experiments were significantly more complex and began with a male/female pair of ambush bugs. The pair were left to themselves and observed for the start of precopulatory mate-guarding. Once this guarding behavior was detected, new males or new females were added in groups of one or three. The pair was checked every 10 minutes upon formation in order to differentiate between the premate-guarding phase and the post mate-guarding phase. Then the durations of precopulatory guarding, postcopulatory guarding, and copulation were recorded. I found the males in each treatment were aggressive and often displaced each other. These displacements created difficulties with data collection, mainly a lack of data, as the initial male was not able to complete the copulatory and/or postcopulatory phase in many of the trials. The addition of females to the experiment did not produce the same complications, as the new females made no attempt to aggressively displace the initial pair. However, the most important and least expected discovery was that the addition of females to a preformed pair caused the initial male to postcopulatory-guard longer in comparison to other treatments where additional males were added. This contradicts the mate-guarding hypothesis, because one would



expect to find the presence of more males, rather than females, would lead to a longer postcopulatory guarding phase. The fact that the data was contradictory to this hypothesis suggests that something else may be happening in ambush bug mating. As I continue to study mate-guarding, I will examine whether female choice plays a greater role in the behavior than previously understood.

Although I graduated in May, I intend to continue my work with ambush bugs this summer and hopefully come to a conclusion about the significance of mate-guarding. I also plan on attending medical school in the fall of 2011, where I look forward to continuing with research and possibly earn both an M.D. and Ph.D. As I leave college, I know whatever I do and wherever I end up, research

will continue to be a large part of my life and for that I would like to thank the outstanding faculty mentors I have had here at Syracuse University.

## UNDERGRADUATE STUDENT PROFILE:

### Amy Rabideau



I entered Syracuse University in August 2006 interested in biology and with the intention of going to medical school after my four-year undergraduate tenure. Looking back, I realize that it is what I did to prepare for my future career that led to my discovery of my passion for biological chemistry research and, ultimately, a change in career goals.

As a second semester freshman, I started volunteering at SUNY Upstate University Hospital as a Child Life volunteer in the Pediatric Oncology/Hematology Division. My job was to address the needs of the children and their families during their hospital stay. I read with school-aged children connected to IV poles, watched cartoons with sick toddlers, and rocked tired infants back to sleep. The smiles and laughs that I shared with these children left a lasting impression on me. During my first semester at Upstate, I quickly realized that I wanted to help my sick friends as more than a Child Life volunteer.

Back at Syracuse University, as a chemistry and biology dual major, I set my sights on learning more about science research and the promise it holds for people afflicted with disease. I was

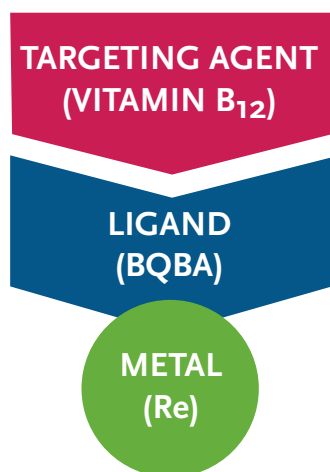
introduced to independent biological chemistry research in the spring of my freshman year, during the second honors general chemistry laboratory class, CHE 139. Taught by Professor Robert Doyle, the class consisted of first-year honors students and advanced chemistry majors. In small groups, we worked on a project to synthesize a metal-based compound with potential anti-cancer effects. By the end of the semester, I realized that I could combine my passion for helping people with my interest in biological chemistry by working as a research scientist.

My experience in CHE 139 led to my interest in Dr. Doyle's studies and ultimately to acceptance into his laboratory to do research. For the last three years, I have worked with Dr. Doyle and his graduate students to synthesize novel vitamin B<sub>9</sub> (folic



acid) and vitamin B<sub>12</sub>-based imaging agents that may prove useful in the early detection of certain cancers. Our most recent studies, which I describe here, involve using vitamin B<sub>12</sub> (B<sub>12</sub>) as a drug carrier for fluorescent, metal-containing ligands.

Vitamin B<sub>12</sub>, also known as cobalamin, is a highly water-soluble compound with a stable carbon-metal bond. It contains a six-coordinate cobalt(III) atom bound to a variable group (i.e. cyano, hydroxyl, methyl or adenosyl), a corrin ring, and a 5,6-dimethylbenzimidazole base group with a phosphoribose unit. The B<sub>12</sub> uptake pathway in cells is complex, containing three known transport proteins and three receptors. Certain cancers, including those of the breast and placenta, often produce cells which over-express B<sub>12</sub> receptors: cubilin, megalin, and/or transcobalamin II. Our objective was to synthesize bioprobes containing transition metals linked to the targeting agent, vitamin B<sub>12</sub>, through a fluorescent bifunctional ligand (see Figure 1). These, in turn, would be taken into and concentrated within the target cells that over-express one or more of the B<sub>12</sub> receptors, thereby indicating the presence of a malignant cell. Uptake of the bioprobes *in vitro* would be detected by a marked increase in fluorescence intensity in cancer cells. This research could be directly applied to the incorporation of radioactive metals for specific *in vivo* detection of tumor cells for diagnostic purposes.

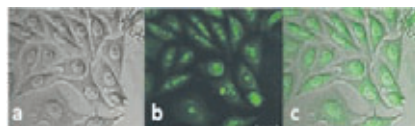


**Figure 1:** The B<sub>12</sub> bioprobe was designed to contain the target molecule (B<sub>12</sub>) conjugated to a rhenium metal-containing bifunctional ligand (ReBQBA).

One specific aim of our project was to conjugate cyano-B<sub>12</sub> to a bifunctional ligand for imaging cancer cells that overexpress the cubilin receptor. The purpose of the bifunctional ligand is two-fold: (1) to bind to the receptor's targeting agent (B<sub>12</sub>) and (2) to coordinate a metal to achieve intracellular fluorescence. We first synthesized the bifunctional ligand, *N,N'*-bis(quinolin-2-ylmethyl) butane-1,4-diamine (BQBA), and then labeled it with rhenium metal to produce the fluorescent bifunctional ligand (ReBQBA). The ReBQBA ligand was conjugated to B<sub>12</sub> by two successive carbonyl substitution reactions to produce B<sub>12</sub>-ReBQBA, the bioprobe to be tested.

Once synthesized, the bioprobe was tested *in vitro* to determine its fluorescence intensity and cytotoxicity in the BeWo placental cancer cell line that overexpresses the B<sub>12</sub> receptor cubilin. To perform these studies, we conjugated the bioprobe containing B<sub>12</sub> to intrinsic factor (IF), a known B<sub>12</sub> transport protein that shuttles the vitamin into intestinal enterocytes by

the cubilin receptor. We demonstrated uptake of the bioprobe in the BeWo cells using confocal microscopy, which detected fluorescence at ~560 nm after being excited with visible light at 488 nm, as seen in Figure 2.



**Figure 2:** Internalization of B<sub>12</sub>-ReBQBA after 45 minutes of incubation with BeWo cells: (a) bright light image of BeWo cells, (b) fluorescence emission image upon excitation at 488 nm, and (c) merged image of the two simultaneous scans indicated uptake of the bioprobe into BeWo cells after 45 min.

The rapid uptake of the IF-bound drug indicated internalization of the bioprobe by receptor-mediated endocytosis. We also determined the IC<sub>50</sub> value (the concentration at which the drug inhibits 50% of cell growth). The IC<sub>50</sub> value for bioprobe in BeWo cells was in the millimolar range, confirming uptake of the drug with low cytotoxicity.

Future research includes the radiolabeling of the BQBA ligand with radioactive 99m-technetium for *in vivo* studies to determine the biodistribution of the bioprobe with respect to the tumor cells. Research is ongoing in the Doyle lab to produce a water-soluble rhenium-containing B<sub>12</sub> bioprobe for better biocompatibility with cells at physiological conditions. Additional projects include the synthesis and *in vitro* investigation of lanthanide metal-based B<sub>12</sub> bioprobes for targeting and imaging breast cancer cells.

Medical imaging has become increasingly important to cancer research and medical practice. From magnetic resonance imaging (MRI) to computed tomography (CT) scanning, the development of imaging technology has led to more sensitive methods that enable physicians to more confidently detect malignancies at an early stage of tumor growth. While significant progress has been made in the field of medical imaging, there are still challenges that must be overcome in order to continue progression, including the development of target-specific bioprobes with heightened specificity and minimal toxicity.

The biology and chemistry departments at Syracuse University have afforded me the opportunity to pursue my interdisciplinary academic and research interests. The results of my research have led to two publications in peer-reviewed scholarly journals, *ChemMedChem* and the *Journal of Medicinal Chemistry*, and another in progress. I look forward to continuing biological chemistry research in graduate school as I work toward my doctorate degree at the Massachusetts Institute of Technology.



## UNDERGRADUATE STUDENT PROFILE: Jamie Rachelle Sherman

It was a pitch-black night, and the crisp air smelled of fresh wildebeest blood and day-old dung. The night's silence was quickly broken by the deep roar of a male lion coming to assess the next meal for his pride. He stepped toward the bait with the two leading lionesses of his pride. Three shots pierced the air, and the lions flinched and stumbled away in confusion. From the time they hit the ground, we had exactly 30 minutes to collect all the data and samples before the lions regained consciousness. Our night's work began as we swiftly jumped out of the 4x4 into the open South African savanna. As I ran toward the sleeping carnivore ahead, I realized that I belong in the field and became invigorated by the learning associated with wildlife research.

My first South African adventure arose circuitously from a lifelong interest in veterinary science and desire to travel. In fall of 2008, I enrolled in a wildlife/ecology SU Abroad Partners Program through the Organization for Tropical Studies and Duke University in South Africa. While abroad, I was exposed to a sector of biology outside the classroom or clinic, and I loved it. With a newfound confidence in my field skills and passion for African wildlife, I saw a perfect opportunity to extend my stay abroad through research. Working in conjunction with Kruger National Park Veterinarians; my research advisor, Dr. Mark Ritchie; and the Renée Crown Honors Program, I designed a project that would later become my Honors Capstone and Distinction thesis.

In summer 2009 I returned to the Kruger as a researcher instead of a student. I worked as part of a team of park veterinarians to capture and relocate African Cape buffaloes, elephants, white rhinos, and lions. Many people travel on safaris to capture a glimpse of Africa's big five (elephant, lion, rhino, Cape buffalo, and leopard). I left the continent having touched four of those five wild animals.

Inspired by a study conducted in the Serengeti on the effect of hemoparasite burdens on coinfections in African lions, I decided to extend that investigation to include the lions of Kruger National Park. Hemoparasites are hemoflagellates or filarial worms found in animal blood. These parasites

are transmitted by arthropod vectors, such as ticks, that are commonly observed in domestic animals and wildlife. Although they can cause serious illness in domestic species, they often persist at low levels in wildlife without compromising health. In isolation, hemoparasites do not appear to cause serious illness; however, when they are combined with other infections or found in immuno-compromised individuals, clinical symptoms can appear. I investigated four specific hemoparasites that are often observed in lions: *Babesia*, *Theileria*, *Cytauxzoon*, and *Hepatozoon*. It is important to understand hemoparasite burdens in wildlife, including free ranging lions, for the general health of these animals, and to determine the threat such infections pose for domestic species. Enlightened wildlife managers coupled with thorough wildlife disease investigations would be beneficial in resolving epizootiologic problems early and to prevent the needless sacrifice of wildlife populations.

I obtained 39 lion blood samples and extracted their DNA in an under-equipped lab where syringes acted as a microcentrifuge. After three months of obtaining permits and a week of shipping halfway around the world, my samples arrived in Syracuse. In order to analyze hemoparasite burdens, I used semi-quantitative polymerase chain reaction (PCR). With the help of Professor Ramesh Raina, I designed primers to specifically amplify a known segment of hemoparasite DNA. Using specialized software I was able to quantify my PCR results



and determine the approximate hemoparasite loads of all 39 lions. Finally I looked for trends of infection according to various environmental and species factors including, age, sex, habitat, and locality (pride).

Contrary to previous studies that found parasitic disease prevalence to vary according to habitat, I found that trends of infection might actually be dependent on gender. There was no evidence that age, habitat, or locality had a significant effect on hemoparasite loads. More specifically, I found that male lions had greater parasite burdens than females. This finding might indicate that males are more susceptible to disease, independent of age, land system, or locality. The reason why the parasite loads are higher in male lions is unknown. We are considering the possibility that infection is spread and amplified in male populations due to the aggressive social behaviors exhibited within and between prides. It has also been hypothesized that higher testosterone levels can result in immunosuppression, thus leaving males more susceptible to infection.

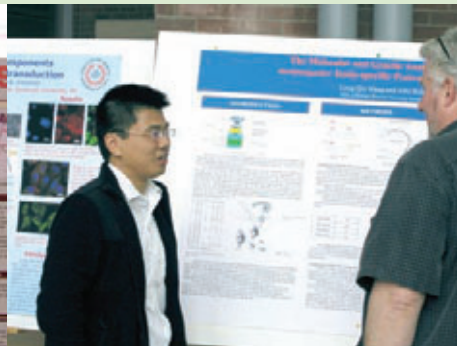
Over the past two years, a large majority of my time has been focused on answering questions surrounding lion health and hemoparasites. But with graduation approaching, I had to expand my thinking beyond the laboratory and the African

savanna to my future, and even a bit of my past. By far, the number-one most common question I have received over the past few months is, "What are you doing next year?" Well! I'll be moving across the country to start my graduate study in animal science at the University of California, Davis. I have a passion for science and a passion for research, which has led me to pursue a graduate degree with a focus in wildlife disease ecology. The next most common question has been, "Are you happy about leaving Syracuse?" I certainly won't miss the weather. However, I will miss the engaging students and the supportive faculty. I would not have become the person I am today nor had the opportunities to travel and study abroad at another institution. The combination of my personal drive and the overwhelming encouragement from various faculty members made Syracuse University the ideal environment for my undergraduate education. I am sad to leave such an environment, but I am excited to move forward with my career as a scientist, always asking questions and pursuing the answers.

## Undergraduate Research Conference



Vincent Skovia



(left to right) Long Quin Wang and Michael Cosgrove



Poster session in the atrium of the Life Sciences Complex

The 15th annual Undergraduate Research Conference was held April 19 in conjunction with Syracuse University Showcase. A poster session was held in the atrium of the Life Sciences Complex. Posters describing the results of 16 projects were presented. Topics reflected the diversity of opportunities available for undergraduate research at Syracuse University and SUNY Upstate Medical University and, among others, included studies of melanism in flycatchers, geographical barriers to hummingbird diversification, genetic factors involved in plant stress responses

and pathogen defense, structural studies of a protein involved in leukemia, regulation of meiosis, and therapeutics in breast cancer. Mentors for the student participants this year included professors **Uy, Raina, Cosgrove, Pitnick, Fondy, Maine, Ritchie, Chan, Belote, Martin Forstner** (Department of Physics) and **William Kerr** (SUNY Upstate Medical University).





Dick, 9 years old

*A journey back in memory  
and time:*  
*Leipzig 2009*  
*By H. Richard Levy*

**L**ast October I was given an extraordinary opportunity to visit my hometown in Germany for the first time in over 70 years. Here I will share with you the story of this journey and reflect upon some of the memories it stirred up. Before I do, I need to tell you about the events that led up to my leaving Leipzig, where I was born and where I spent the first nine years of my life during a time when Jews were increasingly subjected to oppression. I was incredibly lucky to escape to England in 1939, as I will describe shortly.





After Hitler came to power in 1933, the situation for German Jews steadily deteriorated. It reached a climax on *Kristallnacht*, (the night of the broken glass), November 9, 1938, when Jewish shops and synagogues all over Germany were destroyed and thousands of Jewish men were arrested. It is one of my few clear memories from that time. Early in the morning on November 10, men pounded on our apartment door and shouted vile epithets about Jews. They told us to assemble immediately at a nearby location. It was a raw day, and we dressed warmly. At the last minute, my mother decided not to take my little sister, then only 10 months old, but left her with our trusted maid. I walked between my parents, holding their hands. I was 9 years old and very frightened. As we got closer to the place, I heard loud banging, and I thought: they are killing Jews in there. But it turned out to be a shoe factory, and the whole thing was just a hoax to torment Jews.

As we walked back, we met a lady who was crying and very agitated. She was the wife of the owner of a large, Jewish department store. It was the first time I had seen an adult cry. She said that the windows of their store were smashed, there had been looting, and the synagogue was set on fire. We then met an acquaintance who said that he would board a train to Berlin, and travel back and forth between Leipzig and Berlin until this blew over. My father told my mother he would do the same thing, but would first check whether my grandfather was all right and whether our knitted goods factory was damaged. He would call her from there. That call never came. Meanwhile, when we got back to our apartment building, my mother noticed that our nameplates had been removed, a preface to our pending eviction.

For the next 10 days, my mother tried frantically to locate my father. She eventually heard that he had been viciously beaten, transferred to a prison, and would soon be sent to the concentration camp Buchenwald, a place she had not heard of then. I cried every day he was away and asked my mother how God could let this happen. On the 10th day, my father was released. There were two reasons, apparently, why he was not shipped to Buchenwald like most of the other arrested men. First, demonstrating typical German legal fastidiousness, the Nazis needed him to sign some documents so that they could take over our factory. Second, my father had recently had a major operation for stomach cancer and had a large scar. The Nazis were afraid he might not survive the journey. Later, no one would have such scruples.

Following *Kristallnacht*, my parents realized that the Nazis' noose around the Jews' necks was tightening rapidly. They had already made plans to emigrate, but my escape now became their first priority. At this time the British government agreed to grant refuge to a limited number of children under age 17 years. A similar plan was introduced in Congress in the United States, but it died in committee. These so-called *Kindertransports* were permitted by the Nazis under conditions that the children had to come alone and could only bring one suitcase, no toys. Between November 1938 and August 1939, some 10,000 mostly Jewish children from Nazi Germany and Nazi-occupied territories reached England, thus escaping almost certain extermination. I do not know why I was fortunate enough to be included. Those of you with children can imagine the agonizing decision my parents made to send me, alone, to England, a little boy of 9, not knowing whether they would ever see me again. The children from the *Kindertransports* were billeted out to British families who had volunteered to take them. I was going to a family that my parents knew, though they had never met them: Bernard and Win Schlesinger.

Bernard was a London pediatrician and Win was the daughter of my grandfather's cousin. They offered to take me into their home. They had five children ranging in age from 6 to 13 at that time. The oldest, John, would later become a famous film director, known for



Dick as an 8-year-old with his mother, Charlotte; father Berthold; and sister, Elisabeth





Dick and Karen at the monument to Felix Mendelssohn (a distant relative) in Leipzig. Although Mendelssohn converted to Christianity, the Nazis still considered him a Jew, and his music was banned and the original monument destroyed. The present monument was rebuilt after the war.

such pictures as *Midnight Cowboy* and *Marathon Man*. They also rescued 12 other Jewish children from Nazi Germany and Austria, and placed them into a hostel they established in London with a staff that furnished all the children's financial, educational, social and religious needs. These 12 children, like me, literally owe their lives to this extraordinary couple.

I left Leipzig by train on March 15, 1939. When I said good-bye to my father that morning, my mother knew that I would never see him again as he was already mortally ill. He died only six weeks later. My mother traveled with me and several other children to a town in Westphalia to meet the rest of the *Kindertransport* and to deliver us, and our documents, to the authorities. From there on I was on my own, with a lot of other children, as we traveled to Holland and then by boat to Harwich in England, and by train to London. Win Schlesinger met me at the station and took me to her home. I spoke no English, but Win spoke a little German.

My mother and sister fled to Holland, and then to England on August 27, 1939, on the last KLM plane before the outbreak of war. I was one of the very fortunate few to be reunited with at least one parent. I lived with the Schlesingers but saw my mother and sister every few months.

From the moment I arrived in England, I wanted to forget Germany, and I did everything possible to "become" English. It was a matter of survival in my boarding school, during the war with Germany, where the boys would not understand the difference between a German Jew and a German. I did not want

to speak German, and so I forgot my native language almost entirely until, when I was about 13, I asked my mother to speak and write to me in German and, in that way, relearned the language.

The extraordinary journey I undertook last October came about because of the efforts of a relative in Berlin, Marianne Wintgen, whom I didn't know as she was born after we left Germany. My mother had been very close to her parents and grandfather. Marianne had tried to locate me for several years, and her inquiry to a web site in Leipzig caught the attention of the staff of a German television program called *Die Spuhr der Ahnen* (Traces of Ancestors), which features stories about family ancestry. They, in turn, located me on the web, contacted me and offered to pay for me to come to Leipzig to make a film for their program. In this film I would meet Marianne and we would be taken to various sites in Leipzig that had played an important role in my life there, including a visit to my father's grave. I would be interviewed about my experiences, such as those on *Kristallnacht* and the *Kindertransport*. My wife, Betty, was unable to accompany me, but our daughter, Karen, wanted very much to come along, and the TV network, *Mittledeutscher Rundfunk* (MDR), offered to pay for her also.

On October 3, Karen and I flew to Germany and were accommodated at a very fine hotel in Leipzig. We filmed for two days, beginning with my meeting with Marianne at the main railway station, my point of departure 70 years ago, and which I still remembered. Marianne had only been told the night before that I was alive and in Leipzig. I walked down the platform as though I had just arrived by train, and Marianne looked for me. She recognized me due to my likeness with my grandfather, whose pictures she had seen. We embraced warmly and immediately started a virtually non-stop conversation in German, as she speaks no English. We went to lunch with Anett Friedrich, the director of the film. There, in one of the many moving moments of the trip, Anett gave me copies of several documents she had procured: my father's death certificate; a page from the police blotter from November 10, 1938, corroborating my father's arrest; a document concerning the Nazi takeover of our factory (which ends with the salutation "Heil Hitler!"); and a notice from the secret police to auction a large batch of my mother's books, listing her as "the Jewess Charlotte Sara Levy" (the Nazis required that the name Sara be added by all female Jews, and Israel by all male Jews).

We then went to our former apartment. It is currently used

as a center for abused and disturbed children, and had been made accessible to the MDR. I still remembered some details of the apartment, and Anett's questions reawakened more memories. After *Kristallnacht* in 1938 we were evicted as they no longer tolerated Jews. My mother had the almost impossible task of finding another home. My father was mortally ill. My mother had to look after me and my sister Elisabeth, who was less than a year old. She was preoccupied with trying to get us all out of Germany. Renting



Dick and Marianne examining copy of police blotter recording his father's imprisonment by the Nazis.

Photo courtesy of MDR



to Jews was forbidden. She finally found a small apartment to which we moved early in 1939, and the MDR crew also did some filming there.

We drove to our former knitted goods factory, which had been in the family since 1865. My father and grandfather had been the co-owners. It is now being renovated, but is still partly in ruins.

We went to the Old Jewish Cemetery, where my father is buried. Marianne and I were given a map of the cemetery and were filmed as we located our family plot. Seeing my father's grave was a very moving experience for Karen and me, and I spent several minutes communing with him. The plot right next to ours had been desecrated with the words *Juden Schweine* (Jew pigs). In a filmed interview at the cemetery, I told Anett that it had taken me a long time to be able to talk to Germans without thinking about whether they, or their relatives, were Nazis who had murdered some of my family members or other Jews, but that I had eventually shed that feeling. She said that she is still tormented by questions whether any members of her family were involved in the Nazi atrocities.

Anett had written to ask me whether I would be willing to be interviewed by some reporters and some children who had prepared a gift for me, and I had agreed. The interviews took place at the Jewish Cultural Center. We saw some exhibits there, and Marianne spotted photos of my grandfather. He became the president of the Jewish Community after the war, when only 16 of the 16,000 Jews who had lived in Leipzig remained.



Dick and Marianne at Dick's father's grave, with members of the television film crew

Remarkably, he had survived with his second wife, who was not Jewish, under harrowing conditions.

I was interviewed by two reporters. An article about this interview appeared in the Leipzig newspaper. They asked how I felt about being back in Leipzig and why I hadn't come previously. Then came an especially moving event. Two teenage



Portion of the ruins of the Levy family's knitted goods factory



Photo courtesy of MDR

schoolboys, Julius and Paul, interviewed me. They had worked for the past months on a school project, researching my family and me. They conducted the interview in English and asked some excellent questions. They gave me a beautiful, illustrated, bound book that had been prepared by their teacher, containing the results of their research. The boys' school project had consisted of reading the book and preparing an interview based on its contents. They also gave me a framed receipt from our factory, dated December 9, 1902, featuring the beautiful company logo. This was a remarkable event, one that inspires hope for the future of the German youth.

Karen and I then spent one day in Berlin, which neither of us had ever visited. We went to the Jewish Museum, designed by the Polish-born American architect Daniel Libeskind. Although we only saw part of it, we were most impressed. The tilting floors and the skewed angles at which the walls meet deliberately convey an appropriately disturbing sense of disorientation. We were deeply moved by the numerous displays about the fate of Jewish individuals and families, enabling one to relate personally to these events. We also visited the Memorial to the Murdered Jews of Europe, consisting of some 2,700 concrete slabs. It was jarring to be brought back so vividly to the horrors of the Nazi era after a much more healing time in Leipzig, but a most worthwhile experience.

Karen had to return to the States, but I spent three days in London, visiting friends and relatives. Among them were Walter Weg and his sister Renate Daus, two old school friends from Leipzig who live in London. We spent a wonderful afternoon reminiscing about Leipzig. I told Walter and Renate the following story about their father, which they had never heard and which my mother recounts in her memoirs. After my father died, my mother worked feverishly to escape from Germany with my sister. The Nazis had seized her passport and refused to return

it. The officials at the passport office denied having it, but my mother saw it, as it had a noticeable ink stain. She was in despair whether she would ever get it back, when she remembered my father telling her about a man at our factory who, he thought, could be bribed. My mother had never in her life bribed anyone, but she was desperate, and so she took the courageous step to approach him to see if he could get her passport. He agreed and told her the price. By that time, the Nazis had confiscated all the Jews' money, merely providing them with weekly subsistence allowances. How could she get the money under these strict Nazi fiscal policies? It happened through an extraordinary twist of fate a few weeks earlier. My mother had to sort through our belongings in preparation to pack them. Renate and Walter's father, Fritz Weg, offered to help her. When my mother came across my father's wallet, Mr. Weg suggested that she look inside. To her astonishment she discovered 700 marks there. Having money after the Nazi confiscation constituted an extremely serious offense that might have cost her life. She couldn't imagine why my father had left so much money in his wallet, but then she remembered that shortly after his last business trip abroad, he had to have some surgery, and while he was being anesthetized he mumbled something about money in a wallet. She now realized that this money must have been left after his business trip, and that he had forgotten to hand it over to the authorities. This became the money, then, that she used to pay the bribe, and that is how she got her passport back. Mr. Weg had probably saved her life.

That evening, I met Hilary Schlesinger. She is the sole survivor of the family who took me into their home when I arrived on the *Kindertransport*, and with whom I stayed for seven years. I have been in frequent, close contact with the family ever since, but had not seen Hilary in 10 years. My arrival coincided with her 80th birthday, and since my 80th was just two weeks



later, we decided to have dinner together to celebrate. It was a memorable evening of reminiscing and reconnecting.

On my return flight to Washington, I sat next to a man who told me that his maternal grandparents were German Jews who had left at the same time as I did. His paternal grandparents were German Catholics, and he feels sure that this family included Nazis. He has a master's degree in international law from Harvard and also does pro bono work to help individuals and institutions gain restitution for war-related crimes. This interest arose after he served in the U.S. army in Bosnia and saw the horrors there. This encounter seemed like a fitting conclusion to my journey.

The film, titled *The Little Boy and the Nazis*, was shown on German television on November 25, 2009. I was provided a link to view it before it was aired. It is a skillful mix of Marianne's search for me; our visit to various locations in Leipzig which served as backdrops to the interviews of me; scenes from my childhood, recreated by actors depicting my parents and me; family photographs; and historical footage of *Kristallnacht*, the *Kindertransport*, and Leipzig during the 1930s, including the anti-Semitic signs that were displayed throughout the city. I participated in a chat room after the film. I had never been in a chat room before, let alone one conducted in German on such an emotional subject. There were dozens of participants in the one-hour chat. I was astonished at their reaction. Many viewers were deeply moved. They asked about my feelings at returning to Germany, and many expressed their admiration that I did so. The father of the child actor who played me as a boy wrote



Charlotte and Berthold Levy

that this was a great honor for him. Perhaps my statement about the necessity of letting go of anger and bitterness struck a chord. Obviously, my experiences were not exceptional, and they were trivial compared to those of countless other children, most of whom never lived to tell their tale. Mine had a happy outcome, which may have made it easier for people to relate to. Marianne, who participated in the film with me, thought that it makes a statement against prejudice of all kinds. If so, I am most gratified.

Several things contributed to making this journey such a positive experience for me. Karen's presence meant a great deal. She was supportive and helpful, taking care of practical details, and she kept me emotionally grounded. She was moved by our experiences and was very involved in the whole venture. We shared a unique father-daughter experience. Our warm interactions with the MDR crew also contributed. Every one of them was kind and thoughtful, sensitive to the tenor of the whole event and very respectful of my feelings. We bonded during the interviews, some of which evoked deep emotions in me, and they were drawn into my story. Anett Friedrich, the director of the film, cried on several occasions. All this facilitated my openness with them and contributed, I believe, to the fact that the event was so powerful. Finally, I met Marianne, whose quest for reconnection precipitated this journey, and with whom I have established a warm relationship.

I was struck by the frequent reminders we saw of Germany's role in the Holocaust. In the book the boys gave me there is a section that deals with events in Leipzig commemorating *Kristallnacht*. We saw many classes of schoolchildren being taken to the Jewish Museum and the Memorial to the Murdered Jews. Marianne told us that all schoolchildren from former East Germany were required to visit a concentration camp. This made me think that we have nothing comparable in the United States to deal with the horror of slavery and the post-slavery period, and that, were we to do so, it might help us to deal with our continuing problems concerning race.

Reliving my experiences from seven decades ago emphasized how incredibly fortunate I was. I have never forgotten that I owe this to my parents' courage, the Schlesingers' generosity, the love of both families, and the British government's decision to make the *Kindertransports* possible. They saved my life and laid the foundation for my future happiness. This journey, which I never considered taking until I was invited to do so, was an extraordinary event in my life, something that came unsought and that has profoundly affected me. All those connections to the past lay dormant inside me, and although I have spoken about many of them before, I never relived them. Some painful memories were revived, but some healing took place—healing I didn't know I needed. It underscored for me the importance of letting go of past horrors, a process that began some years ago and that was greatly reinforced by this voyage.

*Editor's note: A similar account of Professor Levy's return to Leipzig is being published in the summer issue of Syracuse University Magazine.*

# Faculty News

**John Belote** presented a seminar “Proteasome gene duplications and spermatogenesis in *Drosophila*” at the Laboratory of Apoptosis and Cancer Biology at Rockefeller University.

**Sam Chan** traveled over the Christmas recess to Hong Kong and Tokyo to attend, respectively, his 50th high school and 45th college reunions. In Hong Kong his former classmates gathered from Canada, U.K., Australia and the United States, but most were from local villages. After initial awkwardness in becoming reacquainted, it seemed half a century had vanished in an instant. In visiting classmates, places associated with his youth, and the gravesite of his parents, Sam says he was overwhelmed with the feeling described in the Chinese proverb of “fallen leaves longing to return to their roots.” Sam says the experience made him feel old, but that didn’t stop him from winning five medals in tennis, badminton and Ping-Pong at the N.Y. Empire State Senior Games in June and, a few years ago, a gold medal as a national champion in amateur tennis for his age group at Palm Springs, California.

**Marvin Druger** has just published *The Misadventures of Marvin* (Syracuse University Press), a book of stories about his adventures and experiences from which we can all draw lessons. His wife, **Pat**, says his misadventures couldn’t possibly fit into one book. A sequel is likely.

**Scott Erdman** is replacing retiring Larry Wolf as associate chair and director of undergraduate studies of the department. In this past year, he continued his connection with Universidad de Salamanca, Spain, by working with visiting Ph.D. student **Alvaro Cuesta Marban** on fungal mechanisms of lipid and membrane homeostasis. Scott was also a member of an integrative NSF grant proposal review panel dedicated to stress biology.

**Reed Hainsworth** retired from the faculty this past year and has moved to Denver Colorado. A review of his contributions is presented in the Chair’s Remarks section of this issue of *BIO@SU*.

**Marilyn Kerr** has replaced retiring Reed Hainsworth as principal advisor for undergraduates. With the number of biology majors rapidly increasing, meeting their needs will be an enormous challenge for her and for the department.

**Mollie Manier, John Belote, Scott Pitnick, Kirsten Berben** and undergraduates **David Novikov** and **Will Stuart** drew international attention for their research using transgenic male *Drosophila* that produce sperm containing fluorescent red or green proteins to explore sperm competition in females inseminated by two males. (*Science*, April 16 issue and reviewed March 19).

**Melissa Pepling** gave a talk in Brown University’s pathobiology seminar series titled “Mechanisms regulating mammalian oocyte development.” This summer Melissa is an invited speaker at the 17<sup>th</sup> Ovarian Workshop and will give a talk titled “Follicular Assembly.” She is an invited mini-symposium speaker at the Society for the Study of Reproduction annual meeting. Melissa’s talk is titled “Estrogen signaling and the regulation of primordial follicle formation.”

**Scott Pitnick** notes the arrival of postdoctoral fellows **Outi Ala-Honkola** and **Stefan Lüpold** from, respectively, Finland and the U.K. The NSF has awarded a second grant in support of the collaborative research with **John Belote** and **Mollie Manier** on sperm length evolution in *Drosophila*. Scott has also joined the editorial board of the new journal *Spermatogenesis*.

**Ramesh Raina** was invited to present the seminar *Molecular Basis of the Plant Responses to the Environment* at Brookhaven National Laboratory last December, and at his alma mater, Banaras Hindu University (BHU), in Varanasi, India, in January. Professor Raina notes with pride that BHU has recently been ranked the top university in India.

**Jason Wiles** has been traveling the world attending conferences and giving presentations in Alexandria Egypt; Cartagena, Colombia; York, England; and Montréal, Quebec. Related to some of these travels, Jason published and presented several papers on his interest in the teaching and acceptance of evolution in Muslim countries. He also gave the commencement address at Ozarka College, Melbourne, Arkansas. A profile of Jason and his teaching and research interests is included in this issue of *BIO@SU*.

**Larry Wolf** retired from the faculty effective August 2010 after 43 years of service. A review of Larry’s many contributions to the department and University is presented in the Chair’s Remarks section of *BIO@SU*.

# news



# Undergraduate Activities and Achievements

## THE UNDERGRADUATE CLASS OF 2009

Each spring the Department of Biology celebrates the achievements of graduating biology and biochemistry students on Senior Honors Day. Students are recognized for academic excellence and research accomplishments. Several of our seniors, as indicated, also earned degrees with distinction in biology or biochemistry in recognition of their successful completion of a high-quality biology/biochemistry thesis. The Donald G. Lundgren Memorial Award—the department's highest honor for undergraduates—is presented for outstanding scholarship and research. This year's ceremony took place April 23.

**RESEARCH ACHIEVEMENT:** Lauren D. Gadeberg, Corey L. Goyeneche, Enxhi Kekezi (also Distinction in Biology), Najwa S. Khan, Diana Lam, Erin M. McGann, Karlton M. Moore, Priya S. Mulji, Anthony F. Paredes, Jamie L. Robinson, Krystyna A. Rotella, Mylenn H. Salinas (also Distinction in Biology), Jamie R. Sherman (also Distinction in Biology), Gabriel O. Sraha, Kendra L. Tatusko (also Distinction in Biology), Fabian Wagner, Philip A. Wagschal, Matthew B. Wong.

**ACADEMIC EXCELLENCE:** Alicia L. Bourne, Hannah C. Burke, Amanda L. DeHaven, Megan G. Hirshberg, Annu T. Joseph, Wesley Kong, Iris Looi, Kacie A. J. MacTavish, James C. McKenzie, Jaclyn Mirault, Anne K. Misiura, Annaabell E. Pellerin, Robert W. Reynolds, Michelle L. Sansky, Kyle A. Saxe, Kirsten M. Thomas, Daniel G. Whitney.

**RESEARCH ACHIEVEMENT & ACADEMIC EXCELLENCE:** Karen M. Adams (also Distinction in Biology), Timothy J. Fokken (also Distinction in Biology), Bertille Gaigbe-Togbe, Pauline Hua, Jenna R. Karavan (also Distinction in Biochemistry), Sukeerti G. Kesar (also Distinction in Biochemistry), Gabriela D. Krawiec, Lisa Pang (also Distinction in Biochemistry), Stephanie L. Teale, Long Qin Wang (also Distinction in Biology), Colin M. Wright.

### DONALD G. LUNDGREN MEMORIAL AWARD FOR OUTSTANDING SCHOLARSHIP AND RESEARCH:

This year two outstanding students were selected for this honor. **Kali H. R. Henn**, whose research was conducted with Professor Scott Pitnick, was also awarded a Distinction in Biology. Her thesis was *Mate-guarding in*

*Ambush Bugs*. **Amy E. Rabideau**, whose research was conducted with Professor Robert Doyle, also received her degree with honors from the Renée Crown University Honors Program. Her thesis was *Production and In Vitro Investigation of Vitamin B12-Based Bioprobes*. Profiles of Kali and Amy and their research interests appear in this issue of *BIO@SU*.

**UNIVERSITY HONORS:** The following biology/biochemistry students were awarded degrees with honors from the Renée Crown University Honors Program. An honors degree requires completion of honors courses and extracurricular activities stressing academics, global awareness, civic engagement, collaboration, and command of language. Students must also complete and defend a capstone project. Those indicated by an asterisk were also awarded a Distinction in Biology or Biochemistry. **Karen Adams\***, **Bertille Gaigbe-Togbe**, **Amory Hillengas** (a dual major, Amory did her capstone project in geography), **Jenna Karavan\***, **Sukeerti Kesar\***, **Gabriela Krawiec**, **Elizabeth Nagle**, **Amy Rabideau**, **Mylenn Salinas\***, **Jamie Sherman\***, **Stephanie Teale**, and **Colin Wright**.

**OTHER AWARDS:** **PHI BETA KAPPA:** Karen M. Adams, Bertille H. Gaigbe-Togbe, Kali Ruth Helen Henn, Cassidy S. Henneman, Wesley Man Hin Kong, Danielle M. Lichtenstein, Nathaniel John Miska, Stephanie L. Teale, Daniel G. Whitney, Colin M. Wright, Sarah D. Zuckerman. **FANNIE LOU HAMER SERVICE AWARD** (given by the African American Studies Department.): **Ryan Sang Ho Freed**; **ANALYTICAL CHEMISTRY AWARD** (given by the Department of Chemistry): **Sean P. Haley**; **BIOCHEMISTRY AWARD** (given by the Department of Chemistry): **Anne K. Misiura** and **Colin M. Wright**; **BIRGE AWARD** (given by the Department of Chemistry): **Stephanie L. Teale**; **CLAYTON SPENCER AWARD** (given by the Department of Chemistry): **Amy E. Rabideau**; **PHI SIGMA SIGMA HONOR SOCIETY AWARD** (given by the Policy Studies program): **Lauren D. Gadeberg**; Two biology students with dual majors were awarded degrees with distinction by other departments. These were **Amory S. Hillengas** in geography and **Kaitlin M. Fitzgerald** in history.

## NEWS OF OTHER UNDERGRADUATES

**CROWN SCHOLARS:** Crown awards are competitive grants awarded by the Honors Program to aid students completing their capstone projects. This year's Crown Scholars include biology majors **Bertille Gaigbe-Togbe**, **Kristina Martimucci**, and **Jennifer Roscoe** and biochemistry majors **Tess Cherlin** and **Colin Wright**.

**RUTH MEYER SCHOLARSHIPS:** These competitive scholarships were awarded by the Department of Biology to support research projects primarily during the summer. This year's awardees and their mentors are: **Aaron Roy** (Erdman), **Tess Cherlin** (Pepling), **Alyssa Lau** (Raina), **Kyle Fahey** (Cosgrove), **Katelyn Heim** (Uy), **Young Son** (Albertson). In addition, **Guang Yu Lee** (Maine) was supported through the **LEVY-DAOUK FUND** and **Maira Concannon** and **Jennifer Roscoe** were awarded support through the **KORCZYNSKI-LUNDGREN FUND**.

**REMEMBRANCE SCHOLARSHIPS:** Each year Syracuse University awards 35 scholarships in memory of the 35 Syracuse University students lost in the bombing of Pan Am Flight 103 over Lockerbie, Scotland, on December 21, 1988. The scholarships are awarded on the basis of distinguished academic achievement, citizenship, and service to the community. Scholarships for 2010-11 were awarded to biology students **Lyuba Polinkovsky** and **Sarah Wendel**.

**Amy Rabideau**, a dual major in chemistry and biology, was one of 12 graduating seniors named 2010 University Scholars. This designation is the highest undergraduate academic honor bestowed by the University. Scholars are chosen by a University-wide faculty committee on the basis of course work, academic achievement, creative work, a personal statement, faculty recommendations, and an evaluation of how each scholar has taken his or her knowledge and experience out of the classroom and engaged the world. Amy was also selected a class marshal by the College of Arts and Sciences. A profile of Amy and her research interests appears in this issue of *BIO@SU*.

# Graduate Student News and Achievements

The following students have defended their doctoral theses since the last edition of *BIO@SU*:

**Stephanie Eby** Thesis: *Fire and the Reasons for Its Influence on Herbivore Distributions in an African Savanna Ecosystem*. Advisor: Mark Ritchie. Stephanie just completed her defense in April. A profile of Stephanie is included in this issue of *BIO@SU*.

**Ting Li** Thesis: *N1a4 and N1a28 Enhancer Binding Protein Modulating Biofilm Development in *Myxococcus xanthus**. Ting's defense was in June. Advisor: Anthony Garza

**Tanya Murray** Thesis: *Arbuscular Mycorrhizal Fungi in Grasslands of Yellowstone National Park: A Role for the Plant-Fungal Mutualism in Grassland Sustainability*. Advisor: Doug Frank. Tanya completed her degree in December 2009 and has been teaching part-time at Saddleback College. She has been applying for postdocs in California.

**Xingyu She** Thesis: *Sophisticated Regulation of Histone H3 Lysine 9 Dimethylation Accumulation During Meiosis in *Caenorhabditis elegans**. Advisor: Eleanor Maine. Xingyu defended in February and is now a postdoctoral fellow at the Salk Institute for Biological Sciences, La Jolla, CA.

**Michele Thorne** Thesis: *Effects of Herbivores, Moisture, and Temperature on Carbon Allocation to Root Respiration in a Heterogeneous Grassland Ecosystem, Yellowstone National Park*. Advisor: Doug Frank. Michele defended in May.

## GRADUATE AWARDS

**Sumanta Bagchi** was the recipient of the 2009 Biology Department Gourevitch Award and the Arts & Sciences Doctoral Dissertation Prize. Sumanta's thesis, *Ecology of the Trans-Himalayan Grazing Ecosystem*, was noted in the 2009 issue of *BIO@SU*, and a profile of Sumanta and his research also appeared in that issue. His thesis advisor was Mark Ritchie.

## ALUMNA PROFILE:

### Allison Fryer B.S. '80

I was not voted "most likely to become a scientist" in high school. Yet, 31 years later I have published over 80 scientific papers and book chapters, trained many graduate students and post doctoral fellows, been an editor for two major scientific journals, a member of several different grant review committees, and a full professor at Johns Hopkins University. I am now professor of medicine and physiology/pharmacology and the associate dean for graduate studies at Oregon Health and Science University in Portland. So how did a not-necessarily-destined-to-be-a-scientist get here?

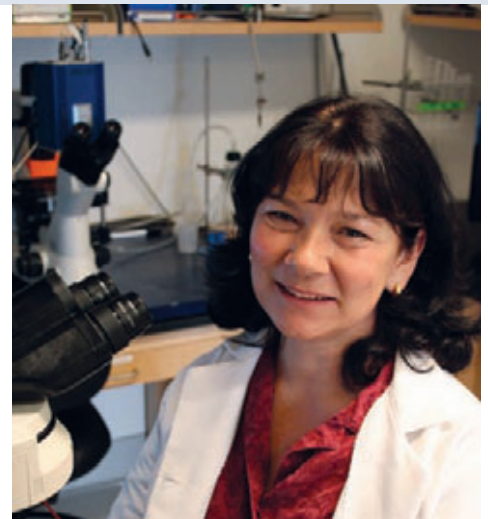
This I believe: Like artists painting from life, we each look at one true thing, but each of us has a different perspective, and our view is colored by our individual experiences. Every paper we have read, every person and mentor we have interacted with, and every experiment we have done shapes our ability as scientists to make connections between seemingly disparate facts and to leap toward new ideas.

Daughter of a medicinal chemist and an artist, I grew up in a house where my father carried out science demonstrations on the kitchen table, while my mother kept our shelves stocked with paints and paper. To both parents I attribute my desire and ability to invent and create. My

introduction to biology came through Mr. Oakley Roark, an influential high school teacher, who in the space of one year introduced me to fetal pig anatomy and fruit fly genetics, and, more importantly, showed me that science was not about repeating classroom demonstrations, but about finding something new. We students roamed through his cupboards and collections to study skulls, shells and slides of bacteria. We pored through copies of *Science* to write weekly reports on anything that interested us from anthrax to *Australopithecus*. However, I was an undeclared, maybe-biology-maybe-English major when I entered Syracuse University in the fall of 1976.

In addition to biology, chemistry

and feeding fruit flies, I dabbled in English, art history and anthropology through my freshman and sophomore years at Syracuse. One summer I took an unglamorous job in a quality control laboratory, where I was exposed to the strict record-keeping requirements of industry, but where I was also able to observe professional chemistry and physiology labs. When I returned to Syracuse as a junior, I studied in Dr. Judith McIntyre's lab, where I learned to work with living animals while genotyping sparrows from feathers. With her encouragement, biology suddenly made sense as a major where I could combine hands, head, creativity and the study of life. I completed my tenure at Syracuse as a volunteer in the laboratory





of Dr. Ernest Hemphill, where I learned sterile techniques, cell culture, and how to measure proteins and manipulate DNA. (As an example of “you never know what interactions will be turning points,” Dr. Hemphill suggested I use influenza viruses as a topic for a paper on evolution which, eight years later, led to a project with my husband that began a life-long collaboration). I graduated from Syracuse with a degree in biology and with the feeling that I could do anything in the laboratory, but still with no clear idea of what that “anything” was going to be.

I accepted a job as a lab technician in a pharmacology laboratory. I confess that I had to look up a definition of pharmacology before the interview, but I accepted the job because it was in England and I was eager to move abroad for a while. I loved England and I loved my job. Part of my training involved rotating through the cardiovascular, inflammatory and central nervous system divisions, and I was exposed to a wide range of techniques and an even wider range of ideas. I settled into cardiovascular pharmacology and learned to measure heart rate, blood pressure and lung function in living animals. Pharmacology is physiology plus drugs and it borrows techniques from all areas of biology to study new receptors, chemical signals, cellular communication, and organ system control. More, it was about the ability of drugs to control and alter these signals that may be changed in disease. I loved that the projects I worked on were directly related to human health and that equations described and predicted interactions of drugs and receptors. My chairman, Dr. Leslie Blaber, was supportive of young scientists. He solicited our ideas and discussed results with us so that we could see the thought process behind the conclusions and use this to help design new experiments. These were the years when I published my first papers, attended my first scientific conferences, and finally felt at home in science, in pharmacology, and in England.

Three years later I was restless at work and eager for more responsibility deciding research project design. Dr. Blaber suggested I apply for an advanced degree, and he was hugely helpful in pointing me toward Dr. Jack Botting, my next mentor. Dr. Botting used the Socratic approach in teaching and prowled through the Chelsea Library each evening to make certain we were reading papers to bring to his tutorials. He, in turn, sent me to the laboratory of my Ph.D. mentor at the University of London, Dr. Jennifer

Maclagan. She taught me to look for big effects, since these are probably important, to design my own experiments, to have confidence in and then to present and defend my own data. The first experiments I did in her laboratory gave a completely unanticipated result, and rather than ask me to go back and do it again, Dr. Maclagan said, “That is interesting; let’s go over the experiment and the controls and see if this could be right.” We spent hours together, drawing out possible pathways and designing experiments to test them. We created a project that would ultimately become six papers worth of data and my Ph.D. thesis. By the time I was finished, I had discovered, characterized and described new receptors on nerves supplying the lungs.

After earning my doctorate and completing postdoctoral fellowships, I joined the faculty at Johns Hopkins University. By this time I was also a wife and was expecting our first child. I planned to write my first grant while on maternity leave, but some of the best advice I ever received came from my department chair, who as a parent of four children told me to write my grant before the baby was born. My husband and I often joke that our three children were born to coincide with grant funding, but we are only half kidding. We made certain that we had enough experiments done before each child was due so that we could slow down for a few months after each birth.

Johns Hopkins was the perfect home for me. As a faculty member in the School of Public Health, I was exposed to environmental science. I learned how to collaborate with other faculty and tested whether air pollution, viral infection, and allergy changed the function of nerves and receptors in the lungs. I learned how to teach and give seminars, and with practice, and Jenny Maclagan’s voice in my head, the butterflies in my stomach before talks began to fade and my seminars were better every year. With age came confidence, and I started to win teaching awards and develop courses. I learned how to plan a budget, defend my papers to editors, and run a laboratory. I also learned how to fire a technician more interested in checking DOW stocks than cell stocks and how to encourage a student who was frustrated by experiments that led to dead ends. For all of these my mentors-of-laboratories-past were making suggestions, whispering advice inside my head.

My scientific progress also grew from the sum of my experiences. Data demonstrating the presence of multiple

receptors on nerves were buried in the literature for decades before I, fresh out of lectures on receptors, looked at my own data and thought maybe receptors on parasympathetic nerves were changing physiological control of the lungs. Images of the lungs were in every histology and pulmonary textbook, but because I had worked with faculty interested in inflammation, we demonstrated that cells alongside the nerves, long overlooked, were actually changing nerve function. I read with everyone else that muscarinic receptors were susceptible to the enzyme neuraminidase, but I was probably the only muscarinic receptor pharmacologist who – because of a college essay on influenza evolution – knew this virus expressed neuraminidase, and who was married to a physician scientist studying mechanisms of virus-induced asthma exacerbations. Together my husband and I demonstrated that viruses block the function of important receptors, which normally limit neurotransmitter release in the lungs. Without these receptors, nerves release too much neurotransmitter, increasing muscle contraction and excessively narrowing bronchi in the lungs; resulting in asthma-like responses.

We moved to Oregon seven years ago for my husband’s promotion, but shortly after arriving, I was asked to direct a graduate program and two years ago was appointed associate dean for graduate studies in the School of Medicine. For every step of my career, I am beholden to the mentors of my past. Our home is filled with paper, paint, seashells and skulls. I browse through *Science* and recall those days in high school with Mr. Roark; I manipulate a pipette and remember Dr. Hemphill; I feel the heart beat of a guinea pig and hear Dr. McIntyre saying “gently now.” Like Dr. Botting, I prefer to teach by tutorial but expect students to be prepared when I invite them to a discussion. Like my department chair in England, I encourage students to try new things. When I sit with my graduate students, I remember Dr. Maclagan’s patient encouragement as we sketch out potential pathways and evaluate experiments with an eye for unexpected results. Students need to learn when to generate alternative hypotheses because they may after all be observing something no one else suspected would happen, and their minds need to be prepared to recognize something new. I am the sum of all my parents, teachers and mentors. Thirty years ago, I would not have predicted my career path, but looking back, I can see exactly how I got here.

## ALUMNA PROFILE:

# Lisa Yeh B.S. '05

Engel, Lisa Yeh and Cristel  
relaxing in a hammock—a  
frequent pastime



Standing in front of a circle of teenagers in rural Nicaragua, I was explaining in Spanish how to put a condom on properly using the end of a broomstick as a prop. As I listened to the embarrassed giggles, I thought: How did I get here? Looking back, I realized this was just one stop along my unique journey to become a health care professional.

I graduated from Syracuse University in May 2005 with a B.S. in biology and a dream of attending medical school. In an attempt to boost my resume and gain real-world experience, I participated in the National Institutes of Health's Intramural Research Training Award (IRTA) program in Bethesda, Md. I truly enjoyed my 16-month mentorship researching *Bacillus anthracis* at the National Institute of Allergies and Infectious Diseases. I learned a tremendous amount, including bacterial gene manipulation, designing DNA primers, determining antibiotic resistance, etc. Nevertheless, I continued to feel I needed a health care experience that would challenge me in ways the laboratory did not.

While attending a casual coffee shop lecture at a trendy D.C. hotspot, a peace law professor from Georgetown University mentioned a former student who volunteered with the Peace Corps and subsequently went on to attend medical school. It dawned on me that was exactly the type of experience I needed – something that would completely remove me from my comfort zone and force me to adapt and develop my own strategies for accomplishing goals. I had always wanted to study abroad in a Spanish-speaking country, and the Peace Corps

offered an opportunity to immerse myself for two years in a different culture and language, preferably while working to improve people's health. After applying, I waited eight anxious months and endured several long medical examinations before receiving an assignment to Nicaragua.

Exactly one year after attending that influential lecture, I departed for Nicaragua to serve as a community health educator. I was expected to form a youth group focused on health-related topics and educate members of the community regarding personal hygiene, HIV/AIDS and other sexually transmitted diseases, reproductive health, and child and maternal health. At first, I scoffed and thought, "Well that's easy; what am I going to do for the remaining year?" Little did I know what behavioral change entailed and how long it would take for people to understand, let alone believe, me.

Upon arrival, my aspirations of positively affecting an entire community immediately collided with the reality of my situation. I believed I would enter a village full of families waiting with open arms for me to share my knowledge and skills to better, and perhaps save, lives. After a couple days in my rural village of about 1,400 Nicaraguans, I realized why the Peace Corps service is at least

two years long. The vast majority of the community did not know who I was or why I was living in their pueblo. I spent the first year acquainting myself, getting to know the villagers, understanding their culture as they learned about mine, and bettering my Spanish language skills. Part of learning the Nicaraguan culture meant understanding their holidays and festivities, and, even more importantly, the roles men, women, and children play. Nicaragua is a patriarchal society where men typically dominate the household, control the money, and hold authority over all others. I discovered how the economic situation, politics and religions drive people's behaviors just as they do in the United States. Some youth in the village were not allowed to participate in the health workshops because we discussed contraceptive options and this was against their religious beliefs. And just as every country has certain superstitions, Nicaraguans seem to really live by theirs. I listened as one 36-year-old mother of eight told the nurse in charge of family planning that she did indeed use birth control; she and her husband ate meals in separate rooms.

Learning the history of Nicaragua was essential to understanding the current state of health and why people in my



village behaved the way they did. In the site where I was stationed, I was prohibited from teaching in the schools because the superintendent thought I might work for the CIA. Years ago, it was rumored that some Peace Corps volunteers in South and Central America were scoping out natural resources for the U.S. government agencies and spying on foreign activities. Decades of war (many of which were fought against the United States), political corruption and natural disasters set Nicaragua back in every economic way possible, creating great needs throughout the entire country. Due to frequent hurricanes, many areas of Nicaragua lack paved roads, and years of deforestation without the means to replant trees leads to massive floods and mudslides every rainy season. It is not uncommon for Nicaraguans in the more rural communities to walk miles up and down dirt paths to reach a health clinic. During my two years, several pregnant women gave birth on the side of the road because they could not make it to the health post in time. Oftentimes, villagers would wait until symptoms and conditions worsened to a point of severe infection or necessary hospitalizations before seeking help. Sometimes this was due to the lack of health education, but another big deterrent was the difficulty of leaving their farm and animals (their main source of income) for days in order to access proper care.

In response to the past devastation, foreign organizations donated millions, and many continue to help Nicaragua build a sound infrastructure, including better roads, sources of clean water, and better farming methods. Many people came to rely on these donations and almost expect them from foreigners. Therefore, working for the Peace Corps, whose informal motto is “do more with less,” was quite a challenge.

Every day was a learning experience. To help pregnant women have a safer delivery, I spent six months in preparations and grant writing to add a maternity ward onto the small health center. However, plans fell through because the community could not figure out how to contribute the mandatory 25% of the total cost. Even the maintenance of a youth group became difficult when adolescents stopped attending because I hadn't gone to their parents' house to ask permission for their child to attend. In another instance, youth stopped coming because the local health center ran out of funding for after-school lunches or snacks. These obstacles kept me on my toes, and I learned to be resourceful and creative in

my methods. I taught the club members how to make cookies, and we alternated assigned snack duty each meeting. The concept of a community bank was novel but appealing to many villagers. The idea that one could save money each week, and then have enough to buy something of greater value like a piece of furniture, or have money in case of an emergency, was initially very attractive. However, when it came to the actual task of setting aside the equivalent of 50 cents to one dollar every week, members had great difficulty because they were so accustomed to living

did not exactly come to fruition, I do have faith that the time and dedication spent educating the villagers had some positive impact on their lives.

At the end of my two-year service, I truly felt that I received more than I gave. I learned so much about instilling behavior change, not only in others but in myself as well. I was a lone United States citizen amongst a majority of people who had never left their village, let alone their country. Many Nicaraguans accepted me and made me feel like I was a part of their families, and the most valuable experience



day to day, never knowing what tomorrow might bring.

I constantly had to adjust my goals to what I felt I could accomplish during my service and alter the strategies by which I approached them. I resorted to working with individuals who trusted me and were interested in learning. Many of the Nicaraguan community health workers who lived in tiny villages off the beaten path were truly interested in bettering the health status of their clients. I worked closely with a couple villages on nutrition, teaching the women how to bake banana bread and utilize ingredients they possessed right in their backyards. I worked with these men and women on personal hygiene, using soap to wash their hands, covering food to discourage flies, and boiling water for drinking. I educated them about the preventability of infections and the importance of early diagnosis and treatment. Although the altruistic notion of directly saving lives in the Peace Corps

I gained were these relationships. The laughter at my mispronunciation of Spanish words, the eager faces as I tried a country delicacy for the first time, the constant interest to learn more about me and my culture – these are the memories that will stay with me for a lifetime.

As a returned Peace Corps volunteer (RPCV), I am currently working as a consultant in a small market research firm that deals with pharmaceutical and biotech companies. It has been a difficult transition from reading in my hammock while sipping freshly squeezed orange juice straight from my backyard to dealing with time-sensitive deadlines and pressured decision-making, but I am very happy to be home and near my family and old friends. I am still in the decision-making process about medical school, but I expect to begin this August. Hopefully, as a physician, I will one day be able to give back to the Nicaraguan community that gave so much to me.

# Who, What, When, Where

**Sonia (Schorr) Sloan B.S. '49** is a retired microbiologist and presently a fund-raising consultant for not-for-profits. Sonia notes she received an M.S. degree in 1950 from Jefferson Medical College, being the first woman to get a degree from Jefferson. She then became the first woman member of the research staff at the Central Research Dept. at DuPont. Sonia currently resides in Wilmington, Delaware.

**Peter C. McCabe B.A. '51, M.S. '52** is retired and living in Pittsford, N.Y. Over the course of his career, he worked for Pfizer, Bristol and Lederle, including studies on live oral polio vaccine and antibiotics.

**Robert F. Reiss B.A. '59** is professor of clinical pathology and medicine at the College of Physicians and Surgeons, Columbia University. He recently retired from his position as vice president and chief medical officer at the New York Blood Center.

**Alice (Clark) Melvin B.A. '66** is now retired and living in Liverpool, N.Y. Alice graduated from the former Bacteriology and Botany Dept. and expresses her gratitude to her professors, with a special thanks to Dr. Richard Levy.

**Robert C. Kuepper B.S. '69** is an oral and maxillofacial surgeon in private practice in Concord, N.H. He is a Diplomate of the American Board of Oral & Maxillofacial Surgery, past chairman of the Dept. of Dentistry, Concord Hospital, and past president of the Concord Dental Society and New Hampshire Society of Oral & Maxillofacial Surgeons. Dr. Kuepper is married to **Martha (Tafarella) Kuepper B.S. '68**.

**Peter McCann Ph.D. '70** (with **Elias Balbinder**) currently works part-time as a financial services representative for MetLife in Sarasota, Florida. Peter has been actively involved in philately for many years and has published articles and two books on the subject. He is the past president of the American Philatelic Society and has recently

been awarded the Alfred F. Lichtenstein Memorial Award for Distinguished Service to Philately.

**John (Jack) Okesson M.A. '71** retired from teaching at Liverpool High School and now lives in sunny Bradenton, Fla. He fondly remembers his experiences assisting in teaching BIO 121-123 and, of course, Marvin Druger.

**Philip McElroy B.S. '72** is staff anesthesiologist at Aria Health, Torresdale Division in Philadelphia, and has also been recognized for teaching excellence by the U. of Penn and the Philadelphia College of Osteopathic Medicine. He and his wife have three children, all now in college. Philip notes he would very much like to hear from his fellow alumni who graduated between 1970-74.

**Steven M. Sobol B.S. '73** is medical director at the ENTA Head & Neck & Thyroid Surgical Institute in Decatur, Ill. Steven notes his fond memories of Druger's Bio 121-123 and doing research in Phil Dunham's lab. His academic surgical career has included head of neck surgery at Memorial Sloan-Kettering Cancer Center, U. of Oklahoma Health Sciences Center and the N.Y. Eye and Ear Infirmary.

**Arnold G. Eversole Ph.D. '74** (with **W. D. Russell-Hunter**) has retired from the faculty of the Dept. of Forestry & Natural Resources, Clemson University. He notes that he is continuing his research on burrowing crayfish and also continues, at a slower pace, to run and bike.

**Marian Price M.A. '77** After many years teaching microbiology at Onondaga Community College and Austin Community College, Marian is now retired and living in East Greenbush, N.Y., a suburb of Albany. She reports five grandchildren, some living close enough to spoil on a regular basis.

**Mark J. Van Husen B.S. '77** is a family practice physician. After completing medical school at Georgetown and a residency at the University of Mass. Medical Center in Worcester, Mass., Mark returned to Liverpool, N.Y., in 1998. He notes that he has quite a few SU faculty as patients.

**Paul M. Simon Ph.D. '78** (with **Tom Fondy**) is president & chief scientific officer of Augmenta Biologicals in Wilmington, Delaware, a start-up company developing Paul's invention for augmenting the potency of vaccines. His career has included numerous industrial and governmental appointments researching inflammatory diseases, immunotherapy, antibodies in drug delivery systems, and antitoxins.

**Bruce Daly B.S. '79** is attending in podiatric medicine, Dept. of Surgery, Bassett Healthcare in Hartwick, N.Y. He and his wife have two girls in college and a son who just graduated from Hobart.

**Toufic Rizk B.S. '82** is division chief of vascular surgery in the Department of Surgery, Unity Health Hospital, Rochester, N.Y. He and his wife have four children.

**Stephanie J. (Brewster) O'Neil B.S. '89** is supervisor of genetic research and development at Children's Hospital, Boston. She is a licensed genetic counselor. After graduating from SU, Stephanie received her M.S. in human genetics from Sarah Lawrence College. She now resides in Cambridge, Mass.

**Robert J. Smyth B.S. '89** is a patent attorney specializing in the pharmaceutical and biotechnology industries. Robert received a Ph.D. in pharmacology from Temple Univ. School of Medicine and a J.D. from Temple Univ. Law School. He lives in Woodbine, Md., and is a partner at Morgan Lewis, Counselors at Law, with an office in Washington, D.C.

**Ted Lee Ph.D. '91** (with **Richard Levy**) has been promoted to professor at SUNY Fredonia.

**Melissa Butts B.S. '00** is a resident physician in internal medicine at the Naval Medical Center, Bethesda, Md. She resides in North Bethesda, Md.

**Sheryl Glassman B.S. '05** earned a doctor of osteopathic medicine degree from the Philadelphia College of Osteopathic Medicine.

**Garret Suen Ph.D. '08** (with **Roy Welch**) has accepted a position as assistant professor in the Department of Bacteriology at the University of Wisconsin-Madison.

**PLEASE SEND UPDATES  
ON YOUR ACTIVITIES TO:**  
**hehemphi@syr.edu**  
or  
**Ernest Hemphill**  
**Room 114**  
**Life Science Complex**  
**107 College Place**  
**Syracuse NY 13244**



# GIVING<sup>TO</sup> BIOLOGY AT SU:

In this issue of *BIO@SU* we are initiating a direct appeal to our many alumni and friends for your help in supporting the programs of the Department of Biology. In these times of fiscal austerity throughout the country, it should come as no surprise that our teaching and research needs have outpaced direct University funding. Whether you donate regularly to SU or are considering a first time gift, we hope that you will consider designating your contribution to support biology at SU. Your support will directly benefit the quality of our teaching programs and research.

Our needs are diverse and encompass all aspects of our program, so we have decided to concentrate our efforts on three areas. Your donation to the Biology Gift Fund can be designated for use in one of the following ways. This fund provides the biology department chair with flexible resources, such as:

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# Orange Central

*Save the Date: October 14-15*

David Revette



The Milton Atrium of the Life Sciences Complex at night